

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>				1. CONTRACT ID CODE N/A		PAGE 1 OF 185 PAGES	
2. AMENDMENT/MODIFICATION NO. 0009		3. EFFECTIVE DATE JULY 26, 2001		4. REQUISITION/PURCHASE REQ. NO. N/A		5. PROJECT NO. (If applicable) SPEC. NO. 1154	
6. ISSUED BY		CODE		7. ADMINISTERED BY (If other than Item 6)		CODE	
DEPARTMENT OF THE ARMY U.S. ARMY ENGINEER DISTRICT, SACRAMENTO DEPARTMENT OF THE ARMY U.S. ARMY ENGINEER DISTRICT, SACRAMENTO SACRAMENTO, CALIFORNIA 95814-2922SACRAMENTO,				DISTRICT ENGINEER U.S. ARMY ENGINEER DISTRICT, SACRAMENTO 1325 J STREET SACRAMENTO, CALIFORNIA 95814-2922 ATTN: CONTRACTING DIVISION			

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)		<div style="display: flex; flex-direction: column; align-items: center;"> <div>(✓)</div> <div style="margin: 5px;">×</div> </div>	9A. AMENDMENT OF SOLICITATION NO.  DACA05-00-R-0018
			9B. DATED (SEE ITEM 11) N/A
			10A. MODIFICATION OF CONTRACTS/ORDER NO. N/A
			10B. DATED (SEE ITEM 13) N/A
CODE		FACILITY CODE	

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers

☒ is extended,
☐ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required) N/A	NOTE: ITEM 13 BELOW IS N/A.
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13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

(✓)	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A. N/A
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority) N/A

**E. IMPORTANT:** Contractor ☐ is not, ☐ is required to sign this document and return \_\_\_\_\_ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) C-130 CORROSION CONTROL FACILITY HILL AFB, UTAH <b>NOTE: The Receipt of Proposals Date has been changed to: AUGUST 10, 2001</b> DELETE: Attachment No. 23 in its entirety. 2 Encl.	
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1. Revised Pages: Cover Sheet, Table of Contents, DD 1707, SF 1442 (2 pages), 00010-5 thru 00010-8, 00100-2, 00100-14, SF 1442, Section 00110, Phase 1 00120-7, Phase 1 00120-8, Section 00120, 00800-3,00800-11, Attachment No. 7, Section 01011
2. Revised Drawings: C2.6, C2.7

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
_____ (Signature of person authorized to sign)		BY _____ (Signature of Contracting Officer)	

# **C-130 CORROSION CONTROL FACILITY**

## **Hill AFB, Utah**

Project will be a two-phase design-build project. *This is Phase 2.*

~~Phase 1 has been completed. is the pre selection phase resulting in the selection of three Offerors (this phase does not include the submission of a cost proposal).~~

~~Only these three Offerors will be allowed to continue to the phase 2 process.~~

RFP NO.                      DACA05-00-R-0018  
SPECIFICATION NO.      1154  
DRAWING FILE NO.        180-25-791



**US Army Corps  
of Engineers®  
Sacramento District**

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PROJECT NO.              KRSM 993014

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## ATTACHMENT NO.

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TECHNICAL SPECIFICATIONS (PHASE 2)  
(SEE TECHNICAL SPECIFICATIONS' TABLE OF CONTENTS FOR  
SPECIFICATION SECTIONS INCLUDED IN THIS SOLICITATION/CONTRACT)

## NOTE:

AS A MINIMUM ANY CONTRACT AWARDED AS A RESULT OF THIS  
SOLICITATION SHALL CONSIST OF THE FOLLOWING DOCUMENTS:

STANDARD FORM 1442, SECTIONS 00010, 00700, 00800, TECHNICAL  
SPECIFICATIONS AND DRAWINGS, AND ATTACHMENTS AS DESCRIBED IN  
CONTRACT DOCUMENT.

SECTION 00600, AS COMPLETED BY AWARDEE, IS INCORPORATED INTO  
ANY RESULTANT CONTRACT BY REFERENCE.

SECTION 00100, **00110 and 00120** ARE INCLUDED FOR SOLICITATION PURPOSES ONLY. **THESE**  
**SECTIONS** WILL BE REMOVED, MAINTAINED IN THE CONTRACT FILE AND  
NOT MADE PART OF THE CONTRACT.

AMENDMENTS ARE INCORPORATED INTO THE RESULTANT CONTRACT.  
SUBCONTRACTING PLAN (IF REQUIRED) BECOMES AN ATTACHMENT TO AND A  
MATERIAL PART OF THE CONTRACT.

PHASE 2 INFORMATION SHALL BE INCLUDED BY AMENDMENT.

**INFORMATION TO OFFERORS OR QUOTERS  
SECTION A - COVER SHEET**

*Form Approved  
OMB No. 9000-0002  
Expires Sep 30, 2000*

The public reporting burden for this collection of information is estimated to average 35 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (9000-0002), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

**PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS. RETURN COMPLETED FORM TO THE ADDRESS IN BLOCK 4 BELOW.**

1. SOLICITATION NUMBER  DACA05-00-R-0018	2. (X one)		3. DATE/TIME RESPONSE DUE AUGUST 10, 2001 / 3:00 P.M.
	<input type="checkbox"/>	a. INVITATION FOR BID (IFB)	
	<input checked="" type="checkbox"/>	b. REQUEST FOR PROPOSAL (RFP)	
	<input type="checkbox"/>	c. REQUEST FOR QUOTATION (RFQ)	

**INSTRUCTIONS**

**NOTE:** The provision entitled "Required Central Contractor Registration" is applicable to most solicitations.

- If you are not submitting a response, complete the information in Blocks 9 through 11 and return to the issuing office in Block 4 unless a different return address is indicated in Block 7.
- Responses must set forth full, accurate, and complete information as required by this solicitation (including attachments). "Fill-ins" are provided on Standard Form 18, Standard Form 33, and other solicitation documents. Examine the entire solicitation carefully. The penalty for making false statements is prescribed in 18 U.S.C. 1001.
- Responses must be plainly marked with the Solicitation Number and the date and local time set forth for bid opening or receipt of proposals in the solicitation document.
- Information regarding the timeliness of response is addressed in the provision of this solicitation entitled either "Late Submission, Modification and Withdrawal of Bid" or "Instructions to Offerors - Competitive Acquisitions".

4. ISSUING OFFICE (Complete mailing address, including ZIP Code) <b>US ARMY ENGINEER DISTRICT SACRAMENTO ATTN: CONTRACTING DIV., RM 878 1325 J STREET SACRAMENTO, CA. 95814-2922</b>	5. ITEMS TO BE PURCHASED (Brief description) <b>SEE SF-1442, BLOCK 10</b>  <b>TYPE OF CONTRACT: SEE SECTION 00100 FAR CLAUSE 52.216-1</b>
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6. PROCUREMENT INFORMATION (X and complete as applicable)	
<input checked="" type="checkbox"/>	a. THIS PROCUREMENT IS UNRESTRICTED
<input type="checkbox"/>	b. THIS PROCUREMENT IS _____ % SET-ASIDE FOR SMALL BUSINESS. THE APPLICABLE SIC CODE IS: _____
<input type="checkbox"/>	c. THIS PROCUREMENT IS _____ % SET-ASIDE FOR HUB ZONE CONCERNS. THE APPLICABLE SIC CODE IS: _____
<input type="checkbox"/>	d. THIS PROCUREMENT IS RESTRICTED TO FIRMS ELIGIBLE UNDER SECTION 8(a) OF THE SMALL BUSINESS ACT.

7. ADDITIONAL INFORMATION
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8. POINT OF CONTACT FOR INFORMATION			
a. NAME (Last, First, Middle Initial) <b>SEE SECTION 00100</b>		b. ADDRESS (Include Zip Code)  <b>SAME AS BLOCK 4 ABOVE</b>	
c. TELEPHONE NUMBER (Include Area Code and Extension) <b>SEE SECTION 00100</b>	d. E-MAIL ADDRESS <b>SEE SECTION 00100</b>		

9. REASONS FOR NO RESPONSE (X all that apply)			
<input type="checkbox"/>	a. CANNOT COMPLY WITH SPECIFICATIONS	<input type="checkbox"/>	d. DO NOT REGULARLY MANUFACTURE OR SELL THE TYPE OF ITEMS INVOLVED
<input type="checkbox"/>	b. UNABLE TO IDENTIFY THE ITEM(S)	<input type="checkbox"/>	e. OTHER (Specify)
<input type="checkbox"/>	c. CANNOT MEET DELIVERY REQUIREMENT		

10. MAILING LIST INFORMATION (X one)	
WE <input type="checkbox"/>	DO <input type="checkbox"/> DO NOT DESIRE TO BE RETAINED ON THE MAILING LIST FOR FUTURE PROCUREMENT OF THE TYPE INVOLVED.

11a. COMPANY NAME		b. ADDRESS (Include Zip Code)	
c. ACTION OFFICER			
(1) TYPED OR PRINTED NAME (Last, First, Middle Initial)		(2) TITLE	
(3) SIGNATURE			(4) DATE SIGNED (YYYYMMDD)



<b>SOLICITATION, OFFER, AND AWARD</b> <i>(Construction, Alteration, or Repair)</i>	1. SOLICITATION NO. DACA 05-00-R-0018	2. TYPE OF SOLICITATION <input type="checkbox"/> SEALED BID (IFB) <input checked="" type="checkbox"/> NEGOTIATED (RFP)	3. DATE ISSUED 00 JUN 07	PAGE OF PAGES 1
	IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.			

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO.	6. PROJECT NO. KRSM 993014
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7. ISSUED BY CODE	8. ADDRESS OFFER TO
DEPARTMENT OF THE ARMY US ARMY ENGINEER DISTRICT, SACRAMENTO CORPS OF ENGINEERS 1325 J STREET SACRAMENTO, CALIFORNIA 95814-2822	DEPARTMENT OF THE ARMY US ARMY ENGINEER DISTRICT, SACRAMENTO 1325 J STREET SACRAMENTO, CALIFORNIA 95814-2922 ATTN: CONTRACTING DIVISION, ROOM 866

9. FOR INFORMATION CALL:	A. NAME SEE SECTION 00100	B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS) SEE SECTION 00100
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### SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, identifying no., date):

C-130 CORROSION  
CONTROL FACILITY  
Hill AFB, Utah  
Specification No. 1154

Description: *Design and construct a new C-130-J30 Corrosion Control Facility of approximately 6,900 M2 located near the flight line at Hill AFB. The facility's primary function will be to provide an environmentally safe facility to perform depot-level corrosion control on C-130-J30 and smaller aircraft. The facility will support the periodic depot maintenance as well as the annual recurring drop-in C-130 aircraft and includes de-painting (striping), washing, and painting. The structure(s) will be permanent construction. Aircraft access between the existing airfield pavement and the new facility along with adequate aircraft maneuvering/parking pavement will be provided. Project includes building foundation/utilities demolition, possible relocation of overhead steam lines and pneumatic lines, excavation, site work, access and area paving, HVAC, fire protection (including AFFF), EMCS, all production equipment, worker maneuvering platform equipment, ventilation equipment, and all necessary features (interior and exterior) to yield a complete and useable facility for its intended use. The project includes the installation of a 44kv/12kv sub-station transformer with 12kv underground service to project site and related features. The project is located on, and adjacent, to the airfield --- access is controlled and airfield safety requirements will be in effect. All electronic systems designed and installed must be Year-2000 and beyond compliant.*

The project will be a two-phase design-build project. Phase 1 **has been completed**. Phase 2 is the technical & price phase where the Offerors develop and submit the project definition design (equivalent to ~ 10% of the design effort) for the project along with a cost proposal.

Estimated Cost Range of Project: \$10,000,000.00 to \$25,000,000.00

\* SECTION 00800, FAR 52.211-10

11. The Contractor shall begin performance within 10 calendar days and complete it within \* calendar days after receiving ☐ award, ☒ notice to proceed. This performance period is ☐ mandatory, ☒ negotiable. (See SEC 00800, FAR 52.211-10.)

12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS?  
(If "YES," indicate within how many calendar days after award in Item 12B.)

☒ YES ☐ NO

12B. CALENDAR DAYS

10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and \* copies to perform the work required are due at the place specified in Item 8 by 1500 (hour) local time AUG 10, 2001 (date). If this is a sealed bid solicitation, offers will be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee ☒ is, ☐ is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

D. Offers providing less than 150 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.  
\*Sections 00100, 00110 & 00120 Encl. 1 to Amend. 0009

**OFFER (Must be fully completed by offeror)**

14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code)		15. TELEPHONE NO. (Include area code)
		16. REMITTANCE ADDRESS (Include only if different than Item 14)
CODE	FACILITY CODE	

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within \_\_\_\_\_ calendar days after the date offers are due. (Insert any number equal to or greater than the minimum requirement stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)

AMOUNTS 

18. The offeror agrees to furnish any required performance and payment bonds.


**19. ACKNOWLEDGMENT OF AMENDMENTS**

(The offeror acknowledges receipt of amendments to the solicitation - give number and date of each)

AMENDMENT NO.										
DATE										
20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)						20B. SIGNATURE			20C. OFFER DATE	

**AWARD (To be completed by Government)**

21. ITEMS ACCEPTED:

22. AMOUNT		23. ACCOUNTING AND APPROPRIATION DATA	
24. SUBMIT INVOICES TO ADDRESS SHOWN IN (4 Copies unless otherwise specified)		ITEM	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO <input type="checkbox"/> 10 U.S.C 2304(c) ( ) <input type="checkbox"/> 41 U.S.C 253(c) ( )
26. ADMINISTERED BY	CODE		27. PAYMENT WILL BE MADE BY

**CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE**

<input type="checkbox"/> 28. NEGOTIATED AGREEMENT Contractor is required to sign this document and return _____ copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all work requirements identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.		<input type="checkbox"/> 29. AWARD (Contractor is not required to sign this document.) Your offer on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.	
30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (Type or print)		31A. NAME OF CONTRACTING OFFICER (Type or print)	
30B. SIGNATURE	30C. DATE	31B. UNITED STATES OF AMERICA BY	31C. AWARD DATE

## PRICING SCHEDULE

CONTRACTOR SHALL FURNISH ALL PLANT, LABOR, MATERIAL, EQUIPMENT, ETC. NECESSARY TO PERFORM ALL WORK IN STRICT ACCORDANCE WITH THE TERMS AND CONDITIONS SET FORTH IN THE CONTRACT TO INCLUDE ALL ATTACHMENTS THERETO.

## ITEM

NO.	DESCRIPTION	AMOUNT
-----	-------------	--------

**Base Price:**

- |      |   |          |
|------|---|----------|
| 0001 | Design, construct, connect, and test substation transformer/tapchanger with switchgear, substation assembly with grounding and fencing, and underground 12 KV electrical Service from Sub-Station Number 5 to project site, complete and Useable.   | \$ _____ |
| 0002 | Select all equipment for project and design, construct, connect, and test all facilities/features within the 2-meter Bldg line (except as otherwise noted), design and install utility and structural support for all <b>base bid</b> equipment, <b>and option bid equipment, (Note: the work stands/platforms function is now an option bid item but this base bid item No. 0002 shall include structural capacity of the roof system to receive these work stands/platforms) (Note: the wash bay and related site, utility work, and equipment design/installation is not in the base bid. The wash bay footprint shall be sited and shown on all base bid submittals and is required by this base bid item No. 0002. The appropriate site and utility work shall be considered when selecting the site for the wash bay) (Note: includes the DMB bay aircraft wash function design)</b> complete and useable | \$ _____ |
| 0003 | Design, construct, connect, and test all facilities/features outside the 2-meter Bldg line <b>(does not include the Wash Bay)</b> (except as otherwise noted), complete and useable....   | \$ _____ |
| 0004 | Procure, store, install, connect, and test <u>Dry Media Blast Equipment</u> (hose blast system, partial in-floor recovery system, classification systems with the associated hoppers) (equip funds) see equipment listing herein complete and useable....   | \$ _____ |

- 0005 Procure, store, install, connect, and test  
Compressor Room Equipment (two (2) 300 hp  
 compressors, **all required** closed loop  
 cooling systems, dryers, **filters**, breathing air  
 purifiers ~~minimum~~ with associated CO monitoring  
 and alarms) (support all 3 hangars) (equip funds)  
 see equipment listing herein complete and useable.... \$\_\_\_\_\_
- 0006 **Design, construct, connect, and test the Dry**  
**Media Blast process ventilation system (equip**  
**funds), complete and useable.....** \$\_\_\_\_\_
- 0007 **Design, construct, connect and test the Paint**  
**process ventilation system (equip funds),**  
**Complete and useable.....** \$\_\_\_\_\_
- SUB-TOTAL \$\_\_\_\_\_

**Option Bid Items:**

- 0008 (Option #1) Procure, store, install, connect,  
 and test the necessary equipment to provide  
the aircraft wash function in the Dry Media  
Blast Bay. Four (4) each 46 meter long hoses  
 with reels, all required hot water heat exchangers  
 and other support equipment for this function  
 (equip funds), complete and useable. \$\_\_\_\_\_
- 0009 (Option #2) Select all equipment and design,  
 construct, connect, and test all facilities/features  
within the 2-meter Building Line for the Wash Bay  
 (except as otherwise noted), design and  
 install utility and structural support for all  
 option bid equipment, Site location and orientation  
 as defined by base price requirements, (MILCON funds)  
 complete and useable. \$\_\_\_\_\_
- 0010 (Option #3) Procure, store, install, connect,  
 and test the necessary equipment to provide the  
aircraft wash function in the Wash Bay. Four (4) each  
 46 meter long hoses with reels, all required hot  
 water exchangers, and other support equipment (equip  
 funds), complete and useable. \$\_\_\_\_\_
- 0011 (Option #4) Procure, store, install, connect,  
 and test Work Stands/Platforms for Paint  
Hangar (facility mounted mobile telecrane  
 work platforms for wing surfaces, tail surfaces,  
 and fuselage surfaces in Paint Hangar)  
 (equip funds) see equipment listing herein  
 complete and useable. \$\_\_\_\_\_

- 0012 (Option #5) Procure, store, install, connect,  
and test additional Compressor Room Equipment  
(one (1) additional 300 hp compressor, all  
associated closed loop cooling systems, dryers,  
and filters. (support all 3 hangars)  
(equip funds) see equipment listing herein  
complete and useable. \$ \_\_\_\_\_
- 0013 (Option #6) Procure, store, install, connect,  
and test Centralized Chemical tank/pump system  
(tanks and pump systems to deliver Alodine,  
Brightner, and Soap into Paint and Wash Hangars)  
(equip funds) see equipment listing herein  
complete and useable. \$ \_\_\_\_\_
- 0014 (Option #7) Procure, store, install, connect,  
and test High Pressure Wash Equipment  
(support all 3 hangars) (equip funds)  
see equipment listing herein  
complete and useable. \$ \_\_\_\_\_
- 0015 (Option #8) Procure, store, install, connect,  
and test De-Ionized water System (paint hangar)  
(equip funds) see equipment listing herein  
complete and useable. \$ \_\_\_\_\_
- 0016 (Option #9) Design and construct and test  
the upward facing lighting system located  
in a protected trench in the paint bay floor  
slab. Show only the increase in costs over  
the base bid scenario. (MILCON funds)  
complete and useable. \$ \_\_\_\_\_
- 0017 (Option #10) Design, construct, connect,  
and test all facilities/features outside  
the 2-meter Bldg line for the Wash Bay  
(except as otherwise noted), (MILCON funds)  
complete and useable. \$ \_\_\_\_\_
- SUB-TOTAL: ..... \$ \_\_\_\_\_  
(OPTION ITEMS)
- TOTAL: ..... \$ \_\_\_\_\_  
(TOTAL OF BASE PRICE  
PLUS ALL OPTIONS)

1. Prices must be submitted on all individual items of this Pricing Schedule. Failure to do so may cause the proposal to be determined "unacceptable".
2. If a modification to a price is submitted which provides for a lump sum adjustment to the total price, the application of the lump sum adjustment to each item in the Pricing Schedule must be stated. If it is not stated, the bidder/offeror agrees that the lump sum adjustment shall be applied on a pro rata basis to every item in the Pricing Schedule.
3. The bidder/offeror shall distribute his indirect costs (overhead, profit, bond, etc.) over all the items in the Pricing Schedule. The Government will review all submitted Pricing Schedules for any unbalancing of the items. Any submitted Pricing Schedule determined to be unbalanced may cause the proposal to be determined "unacceptable".
4. The successful bidder/offeror grants the options listed in the Pricing Schedule to the Government. OPTION NO. 1,2,3,**9** and **10** (if exercised) will be exercised not later than ~~150~~ **30** calendar days following Notice to Proceed (NTP). OPTION NO. **4, 5, 6, 7 and 8** (if exercised) will be exercised not later than ~~30~~ **150** calendar days following Notice to Proceed (NTP). Exercise of the option occurs upon mailing of written notice to the Contractor. Exercise will be made by the Contracting Officer. The price for exercise of the option includes all work and effort associated with the scope of that item. No additional time for contract completion will be allowed when an option is exercised. The given contract completion time was formulated to include time necessary to perform all option work.
5. EFARS 52.214-5000 APPARENT CLERICAL MISTAKES - ARITHMETIC DISCREPANCIES (DEC 1995)--EFARS
  - (a) For the purpose of initial evaluation of bids/offers, the following will be utilized in resolving arithmetic discrepancies found on the face of the Pricing Schedule as submitted by bidders/offerors:
    - (1) Obviously misplaced decimal points will be corrected;
    - (2) Discrepancy between unit price and extended price, the unit price will govern;
    - (3) Apparent errors in extension of unit prices will be corrected;
    - (4) Apparent errors in addition of lump-sum and extended prices will be corrected.
  - (b) For the purpose of bid/offer evaluation, the Government will proceed on the assumption that the bidder/offeror intends the bid/offer to be evaluated on basis of the unit prices, the total arrived at by resolution of arithmetic discrepancies as provided above and the bid/offer will be so reflected on the abstract of bids/offers.
  - (c) These correction procedures shall not be used to resolve any ambiguity concerning which bid is low.
6. The target ceiling for contract award for design and construction is **\$14,900,000.00** (MILCON) and \$9,170,000.00 (EQUIPMENT) based on the funds made available for this project. The Government cannot guarantee that additional funds can be made available for award. Offerors are under no obligation to approach either of these ceilings.

(5) For prospective bidders/offerors with electronic mail capabilities, questions of a contractual or technical nature can be sent to thart@spk.usace.army.mil or mshupp@spk.usace.army.mil. Please include the full name of your company, as well as telephone and fax numbers, in your correspondence.

(6) Oral explanations or instructions are not binding. Any information given to a bidder/offeror which impacts the bid/offer will be given in the form of a written amendment to the solicitation.

2. SAACONS 52.0214-4582 DIRECTIONS FOR SUBMITTING BIDS/PROPOSALS (APR 1992)

Envelopes containing bids/offers must be sealed, marked and addressed as follows:

MARK ENVELOPES:

Solicitation No.	DACA05-00-R-0018
Offer Closing Date:	<b>AUGUST 10, 2001</b>
Offer Closing Time:	3:00 PM (LOCAL TIME)

ADDRESS ENVELOPES TO:

Department of the Army  
U.S. Army Engineer District, Sacramento  
Corps of Engineers  
ATTN: Plan Room, First Floor  
1325 J Street  
Sacramento CA 95814-2922

Handcarried bids/proposals must be delivered to:

Plan Room, First Floor, at the above address by the date and time stated above.

Bidders/Offerors are cautioned to allow sufficient time for submission of handcarried bids/proposals. Security measures have been employed which will require all bids/proposals to be scanned prior to being submitted to the plan room depository. These measures are considered to be necessary to insure the safety of our personnel.

(g) Contact SACRAMENTO DISTRICT - **Ms. Michelle Stratton** (916)557-5202 Deputy for Small Business, with questions on the Subcontracting Plan requirements and further instructions on submission of Standard Forms 294 and 295 as required by FAR 52.219-9. These forms with clarifying instructions will be furnished by the Deputy for Small Business to the Contractor's Subcontracting Plan Administrator after contract award.

(h) The accepted Subcontracting Plan will be incorporated into and made a material part of the contract.

(i) The Corps of Engineers highly encourages all bidders/offerors to meet the recommended subcontracting floors as follows:

Small Businesses	61.4%
Small, Disadvantaged Businesses	9.1%
Women-Owned Small Businesses	5.0%

The goals are calculated as a percentage of the TOTAL SUBCONTRACTING DOLLARS, NOT THE TOTAL CONTRACT AMOUNT.

17. FAR 52.222-23 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FEB 1999)

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation for each trade
6.0%	6.9%

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.



## INDEX

## SECTION 00110

## PROPOSAL SUBMISSION REQUIREMENTS AND INSTRUCTIONS

Revised: 17 JUL 2001  
Revised: 02 APR 2001  
Revised: 27 FEB 2001  
Revised: 30 DEC 2000  
Revised: 21 DEC 2000  
Revised: 24 NOV 2000  
01 NOV 2000

## Paragraph

1.0 GENERAL REQUIREMENTS  
2.0 SUBMISSION DETAIL  
3.0 NUMBER OF COPIES  
4.0 NOT USED  
5.0 NOT USED  
6.0 NOT USED  
7.0 DETAILED DESIGN PRESENTATION REQUIREMENTS (PHASE 2)

## SECTION 00110

## PROPOSAL SUBMISSION REQUIREMENTS AND INSTRUCTIONS

## BEST VALUE - TWO PHASE DESIGN-BUILD

PART 1 - GENERAL1. GENERAL REQUIREMENTS:

- 1.1. This is a "Best Value", two-phase design build solicitation for the Design and Construction of C-130 CORROSION CONTROL FACILITY at Hill AFB, Utah. A project description and overall performance requirements for this project are included in this RFP package. The design and construction criteria for this project shall be included in the Phase II RFP package. The solicitation criteria rely predominately upon industry standards and performance oriented requirements, where allowable, to afford the offeror a degree of design flexibility while meeting certain specific project requirements. The successful Contractor must design and construct complete and usable facilities, as described in the RFP documents.
- 1.2. Submit your proposal packages to the Corps of Engineers at the address shown in Block 8 of Standard Form 1442. The Government must receive your proposal no later than the time and date specified in Block 13 of Standard Form 1442.
- 1.3. Instructions for preparation and organization of Phase II proposals are summarized below.

1.3.1. **PHASE II PROPOSALS.**

- 1.3.1.1. The evaluation factors and subfactors to be used to determine the merit of technical proposals and the relative weights assigned to the factors and subfactors are listed below.

- 1.3.1.2. Not used.

1.3.2. **FACTOR 4: OFFEROR'S DESIGN APPROACH WITH CONCEPTS AND SYSTEMS (SUBMIT IN BINDER "A")**

- 1.3.2.1. **SUSTAINABLE DESIGN/GREENING** --- Special emphasis is being placed on environmentally sensitive materials, recycling, and sustainable design and construction principles in this project. This emphasis is added to comply with various executive directives meant to help alleviate the drain of natural resources and reduce the negative impact to the environment some aspects of the construction industry have caused. This emphasis will also provide valuable experience with environmentally responsible design and construction which will be shared with other Air Force and Department of Defense organizations.
- 1.3.2.1.1. The design submittal (all disciplines) shall demonstrate the **Sustainable Design/Greening** features planned to be incorporated into the project by the offeror. **The offeror shall maximize Sustainable Design/Greening techniques in the project such that the cost of the project is not increased.** For this aspect, use the U.S. Air Force document **Engineering Technical Letter (ETL) 00-1: EPA Guideline Items in Construction and Other Civil Engineering Specifications**; see: <http://www.afcee.brooks.af.mil/eq/programs/progpage.asp?rbox=False&type=program&groupcode=0&progid=27>.

- 1.3.2.1.2. The Offeror shall develop drawings and specifications in accordance with the emphasis on environmentally sensitive materials, recycling, and sustainable design. The Offeror shall incorporate these principles into the Concept submittal and clearly indicate these inclusions using bold-italicized lettering. A narrative shall also be provided in the design analysis which clearly identifies these areas of the specifications. This narrative shall be supported with manufacturer's catalogue sheets as indicated below.
- 1.3.2.1.3. Environmentally responsible design considerations are discussed in the Air Force Environmentally Responsible Facilities Guide; see above URL. To the maximum extent possible and practicable, the design shall incorporate recycled content materials as mandated by EPA's Comprehensive Procurement Guide (CPG) and ETL 00-1. Non-availability of materials or technologies, lack of competition, failure to meet performance standards, and unreasonable price are all valid reasons for exclusion of CPG items. Note that in addition to fulfilling the CPG requirements, designers should explore other construction alternatives in the Environmentally Responsible Facilities Guide, as well as other aspects of "green" design and construction currently practiced in industry yet not mandated by EPA or the Air Force. The ultimate goal is to increase sustainability in construction, yet common sense must be applied to decisions made in this area.
- 1.3.2.1.4. Additionally specific items selected for recycled content from the EPA Comprehensive Procurement Guideline shall be highlighted. In addition to desired design features and qualities, obtain manufacturer's information describing percentage of recycled content, as well as the material recycled.
- 1.3.2.1.5. The Offeror shall provide a written analysis of the environmental goals of this project and the Concept design's success in meeting these goals. The Offeror shall also provide a summary of tools examined and processes used to research and implement these goals and their results. Cost comparisons and estimates of material weights and volumes shall be provided as back-up information.
- 1.3.2.2. **DESIGN APPROACH** --- Develop and demonstrate the design approach with concepts and systems your organization will use for completion of the design and construction of this facility using a design/build process. Do not provide alternative designs; provide only your selected concepts and systems. It is acceptable to use specific manufacturer's product information to define your selected concepts/systems but supporting selection information must be included. **The entire scope of the project must be addressed in this proposal.** The format for this section shall follow instructions herein --- there is no limitation on drawing sheets or written pages in support of this factor. In addition to drawing sheets, include the following:
- 1.3.2.2.1. Present a narrative of your design approach and your unique technical design solutions. The narrative shall cover all features of the proposed design for civil, architectural, structural, mechanical, electrical, fire suppression disciplines, and airfield pavement. The narrative shall also include your approach to demolishing and removing **the foundation, slabs, and utility service lines associated with the former building 271**, including the associated hazmat abatement work. If the Offeror plans to perform construction work during the annual inclement weather period (mid-November → 01 April) (or shows construction work during this period on the schedule) the Offeror shall include a complete narration on construction techniques that will be employed and appropriate referenced inclement weather criteria. The Offeror shall make a statement that his design complies with the most current regulations, standards and codes, or if he is deviating from the most current, to what he is deviating and why. The narrative shall include, but not

necessarily be limited to, the following (this augments instructions herein):

**1.3.2.3. Subfactor 4A: CIVIL**

- 1.3.2.3.1. The Phase II work shall be a detailed narrative and civil drawings, which includes the rationale for the major features of the design. The proposal shall clearly delineate the elements required by instructions herein. In addition to the requirements of the referenced instructions, also explain
  - 1.3.2.3.1.1.the inter-relationship of the new hangars with respect to parking, utilities, vehicular and pedestrian traffic,
  - 1.3.2.3.1.2.a site specific description of the vehicular and pedestrian traffic flow design,
  - 1.3.2.3.1.3.electrical Sub-station No.5 and associated 12kv electrical service alignment between sub-station and project site step-down transformer,
  - 1.3.2.3.1.4.expected hangar-complex loading for each utility connection point,
  - 1.3.2.3.1.5.fire hydrant location,
  - 1.3.2.3.1.6.fire access,
  - 1.3.2.3.1.7.drainage plan,
  - 1.3.2.3.1.8.snow removal and storage plan,
  - 1.3.2.3.1.9.include the industrial waste collection system service definition,
  - 1.3.2.3.1.10. the plan for all geotechnical work to give an understanding of the proposed building foundation and pavement sections design,
  - 1.3.2.3.1.11. the plan for all topographical survey work
  - 1.3.2.3.1.12. cold-weather engineering and construction principles as construction be allowed during the winter as long as sound practices are offered and followed.

**1.3.2.4. Subfactor 4B: ARCHITECTURAL/LIFE SAFETY**

- 1.3.2.4.1. The Phase II work shall be a detailed narrative and architectural/life safety drawings, which includes the rationale for the major features of the design. The proposal shall clearly delineate the elements required by instructions herein. In addition to the requirements of the referenced instructions, also explain
  - 1.3.2.4.1.1.the overall design concept/approach and the relationship of the facility to the site,
  - 1.3.2.4.1.2.life safety requirements,
    - 1.3.2.4.1.2.1. explain how the use of materials, structure and form work together to satisfy functional and aesthetic requirements,
    - 1.3.2.4.1.2.2. describe energy saving devices and long-term low-maintenance features. Discuss the energy budget and method planned for its calculation,
    - 1.3.2.4.1.2.3. describe how the proposed solution achieves compatibility with the surrounding built and natural environment,

#### **1.3.2.5. Subfactor 4C: STRUCTURAL**

- 1.3.2.5.1. The Phase II work shall be a detailed narrative and structural drawings, which includes the rationale for the major features of the design. The proposal shall clearly delineate the elements required by instructions herein. In addition to the requirements of the referenced instructions, also provide:
- 1.3.2.5.1.1. general description of the structural design scope of the project including basis of design and building dimensions of the major structures,
- 1.3.2.5.1.2. description of the structural framing system and materials and of the lateral load resisting system including the anticipated type of foundations and how lateral loads will be transmitted to the foundation
- 1.3.2.5.1.3. description of the roof and floor systems and of unusual design features such as irregular shape, large openings,
- 1.3.2.5.1.4. if the building will have an irregular shape, explain where seismic joints will be placed to create regular shapes or provide a statement that a dynamic analysis of the building will be performed,
- 1.3.2.5.1.5. description of the structural systems and type of construction of lesser-related structures,
- 1.3.2.5.1.6. provide a list of design criteria, design loads and assumptions, and computer software used for analysis.

#### **1.3.2.6. Subfactor 4D: MECHANICAL/PROCESS EQUIPMENT/PLUMBING/FIRE PROTECTION**

- 1.3.2.6.1. The Phase II work shall include at a minimum-detailed narratives and engineering drawings of the mechanical/process equipment/plumbing/fire protection systems, which includes the rationale for the major features of the design. The proposal shall clearly include and delineate the elements required by the "Specific Engineering And Design" Criteria document and the instructions herein. In addition to the requirements of the referenced instructions, also provide:
- 1.3.2.6.1.1. tele-crane layouts including tele-crane storage and maintenance area
- 1.3.2.6.1.1.1. Details shall include at a minimum layouts of the ~~four (4)~~ **three (3)** gantry mounted overhead telecranes with rotating work platforms (~~two (2) each one (1)~~ for the wing/forward fuselage, and two (2) each for the tail/empennage). The layouts shall show how the telecranes will provide man access from ground level, (platform bottom max 12" AGL), to all upper surfaces of a C-130. Details shall include the layout of the utility/plumbing track-type festoon systems, and the automatic emergency back up power system and breathing air systems.
- 1.3.2.6.1.2. Dry Media Blast equipment layouts
- 1.3.2.6.1.2.1. Details of the media cleaning/classification system shall include a flow diagram, equipment room elevations and floor layouts, including storage hoppers, media cleaning/classification equipment, dust containment systems, pneumatic transport systems, waste disposal systems, and HPS bypass system details. Vibratory separator and HPS OEM manufacturers cut sheets shall be provided. Details of the blast pots, hoses, and media feed/air pressure controls shall be provided.

- 1.3.2.6.1.2.2. Details of the dry media partial in-floor recovery system ducting shall include at a minimum in-floor duct and transfer system layout, recovery duct cross-section views (end and side views), media entry point details, duct lifting details, removable water covers and seals, media recovery trough water drain details, potential water entry considerations, transfer piping detail, and grating support. Conveying air CFM and motor HP engineering data shall be provided for all pneumatic conveying systems.
- 1.3.2.6.1.2.3. NOTE: All DMB designs and drawings submitted must be provided with a state registered Professional Engineer (PE) stamp from the engineer at the DMB supplier company.
- 1.3.2.6.1.3.chemical tank/pump system layouts
  - 1.3.2.6.1.3.1. A layout of the chemical tank/pump room including alodine, brightener, and soap tanks shall be provided.
- 1.3.2.6.1.4.Wash-water (Recycling and Pressure Wash)system layouts
  - 1.3.2.6.1.4.1. A layout of the wet process equipment room including pressure washers, wash-water recycling, and de-ionized water systems shall be provided
  - 1.3.2.6.1.4.2. Details of the floor trough design(s) for all three bays that will tie into the industrial waste treatment plant (IWTP) shall be provided. (Details that show the tie-in to the existing base IWTP are not required). This shall include the manually selectable valving that directs the sump water to either the IWTP or to the wash water recycling system located in the wet process equipment room. Details shall include the floor trough drains man accessible sumps, basins, and weirs to separate and allow removal of solid waste materials. Details for the wash water floor troughs in the DMB bay shall include removable media ingress covers and seals.
- 1.3.2.6.1.5.Compressed air
  - 1.3.2.6.1.5.1. A layout of the compressed air equipment room including air compressors, compressor closed loop cooling systems, refrigerated dryers, breathing air systems, receiver tanks shall be provided
- 1.3.2.6.1.6.Description of the general design approach and the basis of design the HVAC designs. (Summer/winter, indoor/outdoor design conditions for the "During Process" and "Ambient" systems).
- 1.3.2.6.1.7.HVAC systems for each hangar bay and tie-ins including manufacturer's names and type/model of proposed equipment to be used. Details of the systems shall include supply and exhaust ducting, computer controlled heating, during process and ambient air heating systems, and cooling/humidification systems where applicable.
- 1.3.2.6.1.8.For the DMB bay, details of the independent dust collection equipment and wash water ventilation systems shall be provided. These shall include dust collectors, supply ducting, return air ducting, manually operated damper and exhaust air bypass system(s), and the computer controlled heating and humidification systems.
- 1.3.2.6.1.9.Narrative description of the fire protection system to be employed in the project.
- 1.3.2.6.1.10. Life-cycle cost analysis for the following systems:

1.3.2.6.1.10.1. Fire protection for aircraft hangers/paint facilities using under-wing AFFF systems with either fixed nozzle or oscillating monitor nozzles.

1.3.2.6.1.10.2. HVAC systems

1.3.2.6.1.11. Energy Budget Calculations for facility without day lighting

1.3.2.6.1.12. Energy Budget Calculations for facility with day lighting

**1.3.2.7. Subfactor 4E: ELECTRICAL**

1.3.2.7.1. The Phase II work shall comprise of detailed narrative and electrical drawings. The narrative shall include detailed rationale for the major features of the design. The proposal shall clearly delineate the elements required by instructions shown under the administrative clauses of this section. In addition to the requirements of the referenced instructions, also provide:

1.3.2.7.1.1. narrative of the internal, external, and electronic systems required for this project,

1.3.2.7.1.2. description should discuss all aspects of each system including proposed brand name and model.

1.3.2.7.2. Life-cycle cost analysis for the following systems:

1.3.2.7.2.1. Lightning protection system.

1.3.2.7.2.2. Integrated lighting system inclusive of day lighting, direct/indirect fixture lighting, and in-floor up-lighting, and considering loss due to HVAC system.

1.3.3. **Drawings:** Include an appropriate number of drawings to show the required information as called-out by instructions herein. Drawing content will be evaluated with respective subfactor.

**1.3.4. FACTOR 5: MANAGEMENT APPROACH** (~~SUBMIT BY ORAL PRESENTATION~~  
IN BINDER "B")

**1.3.4.1. Subfactor 5A: Key Personnel**

1.3.4.1.1. Identification of Key Personnel: The personnel listed below are considered key personnel for this project.

1.3.4.1.2. Proposed key personnel shall have the necessary knowledge, skills, and abilities to perform their duties in a manner which will ensure successful contract completion; as evidenced by their relevant experience, education, specialized training, and professional registration, as applicable. Applies to:

- o Overall Design-Build Coordinator
- o Design PM
  - Lead Architect
  - Lead Civil Engineer
  - Lead Structural Engineer

- Lead Mechanical Engineer
    - Fire Protection Engineer **(Commitment Letter)**
  - Lead Electrical Engineer
    - Lighting Specialist **(Commitment Letter)**
  - o Construction PM
  - o Construction Project-site Superintendent
  - o Construction Project-site Quality Control Representative
  - o Construction Project-site Safety Manager
- 1.3.4.1.3. Equipment/Systems Supplier Key Person (an individual per firm) education, licensing/registration, and experience with past projects of similar equipment requirement. Applies to:
- DMB system. **(Commitment Letter)**
  - Telecrane system. **(Commitment Letter)**
  - Centralized Chemical tank/pump
  - High Pressure Wash Equipment
  - ~~Wash Water Recycle System~~
  - De-Ionized water System
- 1.3.4.1.4. Submission Requirement: For each of the above persons, and for any additional key personnel identified by the Offeror, provide all of the information specified below:
- 1.3.4.1.4.1. Name of proposed team member;
- 1.3.4.1.4.2. Status (current employee, prospective employee, proposed subcontractor, etc.);
- 1.3.4.1.4.3. Statement of degree of commitment/availability for the project;
- 1.3.4.1.4.4. Minimum qualifications for filling the position;
- 1.3.4.1.4.5. Brief job description that addresses authority, duties and responsibilities.
- 1.3.4.1.4.6. Resume --- see "Format for Submitting Brief Resume of Individual Proposed for Key Position".

**1.3.4.2. Subfactor 5B: Quality Control**

- 1.3.4.2.1. Submission Requirement: Provide a brief quality control synopsis for this project (the official quality control plan will be required of the Contractor once the contract is in place). Describe the Offeror's on-site and home office quality control organization. Separately address the specific procedures the Offeror will utilize during the design and the construction phases to assure delivery of a quality project in a timely fashion. Address authorities and methods of control. Identify by position/job title all on-site quality control personnel for this project and indicate the percentage of time each will be dedicated to this project.



1.3.5. **FACTOR 6: SCHEDULE** (~~SUBMIT BY ORAL PRESENTATION AND SUBMIT IN BINDER "B"~~)

**1.3.5.1. Subfactor 6A: DESIGN AND CONSTRUCTION SCHEDULE**

1.3.5.1.1. Provide the design and construction schedule covering all activity from Notice To Proceed through project completion. Assume NTP date to be Monday, **14 October** 2001 --- this date may slide forward up to 30 calendar days or slide into the future up to 45 calendar days and the Offeror shall accept this adjustment at no additional cost to the Government. Contract duration period shall be 732 calendar days. Offeror may use a critical path or other method of choice to depict the preliminary plan; however, schedules must be graphically represented in a size that is easily read for ease of evaluation; place in the binder. This project schedule will be made a part of the contract. The schedule shall be task oriented, indicating the number of calendar days, after notice to proceed, by which milestones are to be achieved. Give special attention to the following features.

1.3.5.1.1.1. The Offeror shall establish the entire schedule. (See Section 01012)

1.3.5.1.1.2. The Offeror shall schedule each project feature/aspect (as each progresses to completion) to be reviewed by the Government for comment a minimum of two times and not more than three times. This is an important feature --- the Government is not establishing any Offeror **milestone** duration or sequence. The Offeror, by this schedule, shall layout the entire project in such a manner that maximizes Offeror's resources

1.3.5.1.1.3. The Offeror shall utilize the fast-track (parallel design and construction activities) method for scheduling the design process and the construction-start process. Typically construction work is suspended or impacted for winter weather between mid-November and 01 April. Nevertheless, the Offeror will be allowed to perform construction work, during this annual period, but only in strict accordance with industry standards related to such construction. The offeror shall first submit a winter construction plan for review and comment and shall not perform construction during the winter weather period noted above without first receiving authority from the Contracting Officer.

1.3.5.1.1.4. The Offeror shall consider and show on the schedule the following for each design submittal:

1.3.5.1.1.5. Government Review Time = 30 calendar days with slight growth due to weekends and/or holidays; to begin and end on regular work days.

1.3.5.1.1.6. Comment Review Conference = 2 calendar days (to be two adjacent regular work days neither being on a day adjacent to a government holiday or weekend day).

1.3.5.1.1.7. Backcheck Review Time = 28 calendar days with slight growth due to weekends and/or holidays; to begin and end on regular work days.

1.3.5.1.1.8. The Offeror shall determine the content of each design submittal. Each project feature shall be submitted for compliance review a minimum of two times and not more than three times

1.3.5.1.1.9. The Offeror shall show a minimum of thirty (30) line items to describe the design process and a minimum of seventy (70) line items to define the construction process. Include:

1.3.5.1.1.9.1. O&M manual submission and required operator training.

1.3.5.1.1.9.2. turnover of the project. Identify any proposed phased Turnovers. Show turnover Inspections. Show commissioning.

1.3.5.1.1.9.3. as-built submissions.

1.3.5.1.2. Not used.

#### **1.3.6. ORAL PRESENTATION REQUIREMENTS**

##### **1.3.6.1. Oral Presentations**

~~1.3.6.1.1. Offerors included in the competitive range as defined in FAR 15 shall provide an oral presentation not to exceed one hour to the Government on their management approach and project schedule. Information to be presented must be limited to that included in **FACTOR 5: MANAGEMENT APPROACH** and **FACTOR 6: SCHEDULE**. The oral presentation and the question and answer session that follows will constitute "negotiations" as defined in FAR 15.306. Offerors will be requested to submit proposal revisions and/or final proposal revisions for further evaluation within a given time frame following the date of the oral presentation/negotiations. Each offeror will be notified of the date, time, and location of its oral presentation not earlier than 7 calendar days after the date set for receipt of proposals. Additional instructions may be provided at the time of the notification. The oral presentation must be made at a Government provided facility, location to be determined by the Contracting Officer by time of notification of offerors. The Government reserves the right to reschedule an offeror's oral presentation at the discretion of the Contracting Officer. Offerors must respond to the Government's notification of their date/time and location for oral presentation by telephone or fax signifying their commitment to appear on the scheduled date/time and location.~~

~~1.3.6.1.2. Each offeror shall include the overhead transparencies to be used in their oral presentation with their initial technical proposal. Transparencies shall be provided in an "original" (actual transparencies) and 7 paper copies in a separate envelope marked as such. The transparencies must include the company name and be sequentially numbered. There is no limit to the number of overhead transparencies that may be used during the presentation. However, the number of transparencies and the information presented must fall within the one hour time limit. The Government will provide one overhead projector, one flip chart pad, and marker pens for use during the presentation and following question / answer session. Computer software automated presentations /projection equipment will not be allowed. The offeror may not use or submit any other media or documents.~~

~~1.3.6.1.3. The oral presentation shall be presented by up to four (4) of the seven (7) required attendee team members identified as Key Personnel by the Government in Factor 5A and must be attended by the offeror's Overall Design-Build Coordinator, Design PM, Construction PM, Construction Project-site Superintendent, Lighting Specialist, the telecrane system key person, and the DMB system Key Person. The offeror will provide the Government the names and titles of presenters prior to the date set for the oral presentation, in response to the oral presentation schedule letter. The offeror will be allowed a maximum of 5 minutes to introduce the team giving the presentation. The offeror is responsible for managing the allotted time, however the Government will notify the offeror when time has expired. The oral presentation/discussions may be audio or video taped by the Government.~~

~~1.3.6.1.4. After a brief caucus, the Government will conduct a Question / Answer (Q&A) Session which will constitute "negotiations". The Government may ask questions, clarification, and have meaningful discussions with offerors on their oral presentation and any aspect~~

~~of their technical proposal, including Factors 4, 5, & 6. Exchanges will be documented and upon conclusion of the Q&A session the offeror will be given a time frame in which to submit their proposal revision to the Government, based on the exchanges.~~

1.3.7. **FACTOR 7: SOCIO-ECONOMIC CONSIDERATIONS** *SUBMIT IN BINDER "B")*

1.3.7.1. Important Note to Large Businesses: If you are a large business, do not include the Subcontracting Plan as your response to either subfactor. Also, do not simply provide a cross reference to the Subcontracting Plan, which is to be provided by large businesses as part of the Price Proposal.

1.3.7.2. **SUBFACTOR 7A: Participation of Small Business Concerns, Historically Black Colleges and Universities, and Minority Institutions (SBC/HBCU/MI)**

1.3.7.2.1. Submission Requirement:

1.3.7.2.1.1. Note: All Offerors **regardless of business size** status are required to response to this subfactor.

1.3.7.2.1.2. Provide a narrative discussion that addresses the participation of Small Businesses Concerns (SBCs) and Historically Black Colleges and Universities and Minority Institutions (HBCU/MIs) in the performance of work under the prospective contract. You are limited to 1 page for your response to this subfactor.

1.3.7.2.2. **SUBFACTOR 7B: Small Disadvantaged Business (SDB) Participation (limited to the participation of SDB concerns in the performance of the contract under the Authorized NAICS Codes and for construction, by SDB concerns located in the Authorized Regions):**

1.3.7.2.2.1. IMPORTANT NOTES TO ALL OFFERORS PERTAINING TO SUBFACTOR 7B:

1.3.7.2.2.1.1. --See FAR 19.12 for further information pertaining to the requirement for this subfactor. The Authorized NAICS Major Groups/Regions are available on the Internet at:  
<http://www.arinet.gov/References/sdbadjustments.htm>.

1.3.7.2.2.1.2. --All Offerors, regardless of business size status, must respond to this Subfactor.

1.3.7.2.2.1.3. --An Offeror who is proposing the participation of SDB concerns in the performance of the contract (under the Authorized NAICS Codes and for construction, by SDB concerns located in the Authorized Regions) must provide a narrative discussion as described below in response to this Subfactor.

1.3.7.2.2.1.4. --An offeror who is not proposing the participation of SDB concerns in the performance of the contract (under the Authorized NAICS Codes and for construction, by SDB concerns located in the Authorized Regions) must specifically address the rationale for not utilizing such concerns in the performance of the contract. Offerors who present valid reasons for not proposing SDB participation under the Authorized NAICS Major Groups/Regions will not be disqualified from consideration for contract award based solely on the lack of proposed SDB participation under this subfactor.

1.3.7.2.2.1.5. --In order to receive consideration for SDB participation in performance of the contract, when and where authorized (see FAR Subparts 19.12 and the above website URL), offerors must provide,

with their offers, targets, expressed as dollars and percentages of total contract value, in each of the applicable, authorized NAICS Major Groups and a total target for SDB participation by the contractor, including joint venture partners, and team members; a total target for SDB participation by subcontractors. An offeror that is a certified SDB concern must also provide a target for work it intends to perform as the prime contractor. These targets will be incorporated into and will become a part of any resulting contract. Additionally, contractors with SDB participation targets will be required to report SDB participation during performance of the contract. (See the provision at FAR 52.219-24, Small Disadvantaged Business Participation Program Targets, located herein, and the clause at FAR 52.219-25, Small Disadvantaged Business Participation Program-Disadvantaged Status and Reporting, located herein)

1.3.7.2.2.1.6. -- The SDB concerns considered in the evaluation will be listed in the contract, and the contractor shall be required to notify the contracting officer of any substitutions of firms that are not SDB concerns.

1.3.7.2.2.1.7. -- If authorized elsewhere in the solicitation, monetary incentives may be authorized for exceeding SDB subcontracting targets. The incentive, if elsewhere authorized, shall be paid only if an SDB subcontracting target was exceeded as a result of actual subcontract awards to SDBs, and not as a result of developmental assistance credit under the Pilot Mentor-Protégé Program. (See the clause at 52.219-26, Small Disadvantaged Business Participation program-Incentive Contracting, located herein.

**1.3.7.2.2.2. Submission Requirement:**

1.3.7.2.2.2.1. Provide a narrative discussion that addresses the participation in the performance of the work under the prospective contract of SDB concerns under the Authorized NAICS Major Groups and for construction, by SDB concerns located in the Authorized Regions. You are limited to 1 page for your response to this subfactor.

2. SUBMISSION DETAIL: In order to effectively and equitably evaluate Phase II proposals, the Source Selection Board must receive information sufficiently detailed to clearly describe the Offeror's technical approach and performance capabilities.

3. NUMBER OF COPIES: Offerors shall submit an original plus fifteen (15) copies of Phase two Proposals.

4. Not used.

5. Not used.

6. Not used.

7. DETAILED DESIGN PRESENTATION REQUIREMENTS (PHASE II):

7.1. All submissions shall be in accordance with Attachment titled "Design Submittal Requirements" except as modified by the following paragraphs below. All criteria referenced in Section 01010 and Section 01011 of the RFP shall govern over criteria specified in Attachment 15.

7.1.1. The design submittal shall be accompanied with **appropriate letters of commitment as defined in Section 00110, Factor 1. ~~a letter from each sub-contractor/supplier having direct construction/materials/equipment defined within the submittal. The purpose of the letter is to bring together the designers and the subs slated to accomplish the work and the suppliers of the material and equipment. These submittals shall~~**

~~be an all-hands effort by the design-build team. Each sub and supplier shall state their involvement in the preparation of the submittal, their proposed activity during the design-build contract associated with the contents of the submittal, and state the design is appropriate for their related field and appropriate for their capabilities/expertise. Each letter shall be on the sub's/supplier's letterhead and signed by a principal of the firm.~~

7.2. The submittal shall also discuss the issue of equipment and facility maintainability and accessibility. Discuss repair turnaround time, spare parts staging areas, and locations of authorized repair centers/firms for each of the major pieces of equipment shown on the bid schedule as associated with equipment funding.

### 7.3. Architectural

7.3.1. For evaluation for the final selection of offeror, proposers shall submit items as described in "Concept Design Submittal" of the "Design Submittal Requirements" attachment including the following items.

7.3.2. Rendering requirements for proposal:

7.3.2.1. Aerial Views (Sketch Version Renderings --- two color rendering perspectives required as a set): (scale as appropriate for clarity). Render using pen and marker techniques which adequately illustrate the exterior materials, colors, and design intent. These perspectives shall be presented in no smaller than 11 inch by 17 inch format.

7.3.2.2. Show the following:

7.3.2.2.1. Bird's eye or roof top perspective of the project to include as much of the surrounding area and existing building as necessary to depict the new facility and its contextual setting. However, be careful not to choose an angle so high that the drawing is dominated by the roof. No dimensioning. This is a required rendering.

7.3.2.2.2. Eye-level perspective focusing on the building design and its significant architectural features. Typically, the most prominent entrance or facade is portrayed. The angle is at the discretion of the designer in thesis cases. No dimensioning. This is a required rendering.

7.3.3. For tabulation of gross area as required in par. 1.3.2.2(b) of Attachment "Design Submittal Requirements", see Attachment titled "Gross Area Takeoff" sample plate for instruction.

### 7.4. Civil

7.4.1. For evaluation for the final selection of offeror, proposers shall submit items as described in "Concept Design Submittal" of the "Design Submittal Requirements" Attachment including the following items or ammended as follows.

7.4.2. The format and quality of the drawings shall be as indicated ~~in Attachment 7 "Drawing Format"~~ here **in**.

7.4.3. Design alternatives are not required. One design solution is required.

7.4.4. Landscaping is not part of this project. Railroads are not part of this project.

## 7.5. Structural

- 7.5.1. For structural evaluation for the final selection of offeror, proposers shall submit items as described in "Early Preliminary Design Submittal" of the "Design Submittal Requirements" attachment including the items specified in the following paragraphs.
- 7.5.2. A narrative describing the proposed structure's lateral support system with specific details on seismic criteria, seismic coefficient values and loads prepared by the structural engineer.
- 7.5.3. A narrative describing the proposed crane type, the method of supporting the crane and applicable design criteria and standards. Indicate the locations of cranes and the limit of operation on framing plans.

## 7.6. Mechanical

- 7.6.1. For evaluation for the final selection of offeror, proposer shall submit items as described in "Concept Design Submittal" of the "Design Submittal Requirements" attachment.
- 7.6.2. The package shall include as a minimum the following:
  - 7.6.2.1. The process design package shall show the proposed means of controlling the de-painting process equipment. This shall include:
    - 7.6.2.1.1. a process flow diagram and detailed narrative of all dry media blast (DMB) media recovery and cleaning equipment (plastic shall be the dry media used for this project),
    - 7.6.2.1.2. descriptions of all operator/supervisor controls, media storage hoppers,
    - 7.6.2.1.3. level probe functions (including process equipment on/off and delays),
    - 7.6.2.1.4. equipment bypass operations, and blast equipment functions and controls.
  - 7.6.2.2. The package shall include manufactures cut sheets for all mechanical equipment in the proposed design.
  - 7.6.2.3. The process design package should show the proposed means of controlling the airflow, velocity, exhaust/recirculation, temperature (heating and cooling), and humidity for each of the three bays (Paint, DMB/Wash, and Wash). This description shall be in the form of a written narrative with calculations, drawings, controls, and flow diagrams. The package shall include manufactures cut sheets for all mechanical equipment in the proposed design.
  - 7.6.2.4. Details of the wash bay ventilation system shall include the supply ducting, return air ducting, manually operated damper and exhaust air bypass system(s), and the computer controlled heating system.
  - 7.6.2.5. The process design package should show the proposed means of controlling and distributing the chemical and wet processes to and from all three bays (paint, DMB/wash, wash). This shall include plumbing distribution/containment/sumps/drains, process flow diagrams, descriptions of all operator/supervisor controls, valves/pumps/and level control functions. The package shall include

manufactures cut sheets for all mechanical equipment in the proposed design.

7.6.2.6. The fire protection plan for the entire facility.

7.6.3. The submittal shall discuss the availability of replacement parts for all equipment systems. Discuss where the replacements parts are staged (city/state/country) and the turn-around time for receipt. Discuss location (city/state/country) of firms authorized to work on equipment.

## 7.7. Electrical

7.7.1. For evaluation for the final selection of offeror, proposers shall submit items as described in "Concept Design Submittal" of the "Design Submittal Requirements" attachment including the following items.

7.7.1.1. A comprehensive design analysis describing the basis for sizing of equipment and selection of support equipment, lighting (foot candle) levels & grounding ohmic values for both substation #5 and the C-130 Corrosion Facility covering the following. Design analysis shall include a discussion on advantages and disadvantages of day lighting as required under options of Pricing Schedules.

7.7.1.1.1. Substation Transformer.

7.7.1.1.2. Substation Switchgear.

7.7.1.1.3. 12 kv Feeders.

7.7.1.1.4. Outdoor type Pad-mounted Transformers.

7.7.1.1.5. Tabulation showing Lighting Level Criteria References and actual Foot-candle levels used for various area of the building.

7.7.1.1.6. Lightning Protection, Grounding and Bonding Criteria and Ohmic Value Levels for both substation grid and C-130 building.

7.7.1.1.7. 12 kv Feeder routes.

7.7.1.1.8. Discuss various features of electrical systems and subsystems.

7.7.1.1.9. Narrative on Equipment and Alarm Devices needed to execute Hazardous Occupancy and Life Safety considerations.

~~7.7.1.2. Also indicate how much extra capacity is allowed for future loads such as Doghouses.~~

7.7.1.3. Contractor shall provide a Definition Summary sheet of building structures and substructures which will be affected by Daylighting such as reconfigured elevations and cross sections. In the same summary sheet discuss new required features such as lighting controls, glazing type and its lighting-impact, automated window controls, projected change in energy consumption, and other such features. This Definition summary sheet will be used to evaluate the scope of modifications required due to Day-lighting.

7.7.1.4. Equipment drawings shall be submitted for FIO and/or GA per applicable documents.

7.7.1.5. All submittals shall also comply with the requirements of (enclosed) attachment #15 except that paragraphs, references with following titles are Not Applicable to this project.

7.7.1.5.1. Television, Master Antenna Television and Intrusion Detection Systems.

7.7.1.5.2. Airfield Lighting, Area & Security Lighting and Flood Lighting.

7.7.1.5.3. Tempest|Emp Shielding.

7.7.1.5.4. Generating Plants and Hospital Designs.

7.7.2. The submittal shall discuss the availability of replacement parts for all equipment systems. Discuss where the replacements parts are staged (city/state/country) and the turn-around time for receipt. Discuss location (city/state/country) of firms authorized to work on equipment.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

--End of Section--



#### 4. SELECTION & AWARD

The Phase 1 selection process will result in the selection of not more than three firms for the opportunity to offer proposals for the Phase 2 selection process. These firms will be the offerors that are rated the highest on the Phase 1 evaluation criteria. Award of a Design-Build contract will be made to one of the firms which, in the judgement of the Contracting Officer, represents the best value to the Government. The Government reserves the right to make award to other than the lowest cost offeror, price and other factors considered. The Government also reserves the right to make award without discussions.

#### 5. EVALUATION FACTORS PHASE 1:

The evaluation factors and subfactors to be used to determine the merit of technical proposals and the relative weights assigned to the factors and subfactors are listed below.

The Offeror shall provide the following information to demonstrate capability to properly design and construct the C-130 CORROSION CONTROL FACILITY project. Major evaluation factors and their subfactors are described below. Factor 2 (SPECIALIZED EXPERIENCE/TECHNICAL COMPETENCE) and Factor 3 (PAST PERFORMANCE (EMPHASIS ON QUALITY AND ADHERENCE TO SCHEDULE)) are approximately equal in importance. Factor 1 (OFFEROR'S GENERAL TECHNICAL APPROACH) is approximately half of the importance of Factors 2 or 3. Subfactors 1A and 1C are of equal importance with Subfactor 1B being a pass/fail element. Subfactors 2A, 2B, 2C, and 2D are all of equal importance. Subfactors 3A and 3B are of equal importance and Subfactor 3C is approximately 2/3 of the importance of Subfactors 3A or 3B. Proposals must address the evaluation factors in the order shown.

##### **FACTOR 1: OFFEROR GENERAL TECHNICAL APPROACH**

Subfactor 1A: Project Organization/Responsibilities/Commitment

Describe how the Offeror proposed project team is structured, i.e., list all key firms involved (consultants/sub-contractors/equipment suppliers (air compressor, dry media blast (DMB) equipment, telecranes, and HVAC and filtration equipment) and the responsibility of each firm for this project. If the Offeror has not finalized the proposed project team and more than one firm is under consideration as a prospective key subcontractor or key supplier, identify each such firm and provide letters of commitment ~~for each as~~ **noted below**. Experience and past performance information must be provided for each such firm under consideration as a key subcontractor or supplier in accordance with the applicable subfactors for experience and past performance. Any limitation on referenced projects will apply to each such potential team member. Offeror is not required to identify key personnel under this subfactor.

Provide a proposed organizational chart(s), identifying lines of authority and communication of all key firms (design and construction).

Provide a letter of commitment from each key firm ~~(providing either design and/or construction services and/or supplier services for this project)~~ *(providing fire protection and lighting specialist design services and also providing Dry Media Blast and telecrane services/supplies)* noting their current intentions to commit to join the Proposer to complete this project should Proposer be awarded the contract. In addition, the letters shall note the firm's availability of resources to perform on the project. The letters must be on the respective firm's letterhead and signed by a principal of the firm.

*Evaluation: For Organization/Responsibilities/Commitment, the following will be reviewed:*

- Offeror proposed project team organization chart(s) for completeness, reasonableness, lines of authority, lines of communication (not looking for individuals to be listed)*
- Letters of commitment for completeness, resource commitment, letterhead, and signature by principal of firm.*

Subfactor 1B: Bonding Capacity (Pass/Fail Element)

Demonstrate bonding capability for providing the design/build services for this project. This information shall be in the format of a letter of current bonding capacity from a bonding company.

*Evaluation: For bonding capacity, the following will be reviewed:*

- This is a pass/fail element --- if provided and properly completed, the Proposer remains in the hunt for the project --- otherwise the Proposer drops out of the running.*

Subfactor 1C: Proposed Management Control Systems relating to quality

Demonstrate ability to control product quality throughout the design development and construction of the project. Present brief plans to demonstrate methods to be used to control

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SECTION 00120

PROPOSAL EVALUATION AND CONTRACT AWARD

PARAGRAPH

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- 4.0 SELECTION AND AWARD
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PART 2 (NOT APPLICABLE)

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## SECTION 00120

## PROPOSAL EVALUATION AND CONTRACT AWARD

Revised:	17 July 2001
Revised:	02 April 2001
Revised:	21 December 2000
Revised:	24 November 2000
Revised:	31 October 2000
Revised:	08 September 2000
Revised with am2 info:	05 June 2000
	24 May 2000

## PART 1 - GENERAL

## 1. PROPOSAL EVALUATION

Phase 1 and Phase 2 proposals will be evaluated by a Source Selection Evaluation Board (SSEB). The SSEB will be made up of Corps of Engineers and Air Force personnel. Board members will not be available for contact or discussion prior to, during, or after submission of proposals, evaluation of proposals, or award of contract. Phase 1 proposal and SSEB actions are complete.

## 2. EVALUATION CRITERIA

Phase 2 Criteria. The Management/Technical Proposal outline is noted below. The categories listed below are not listed in any specific order of importance.

**FACTOR 4: OFFEROR'S DESIGN APPROACH WITH CONCEPTS AND SYSTEMS**

Subfactor 4A: Civil

Subfactor 4B: Architectural/Life Safety

Subfactor 4C: Structural

Subfactor 4D: Mechanical/Plumbing/Fire Protection

Subfactor 4E: Electrical

**FACTOR 5: MANAGEMENT APPROACH**

Subfactor 5A: Key Personnel

Subfactor 5B: Quality Control

**FACTOR 6: SCHEDULE**

Subfactor 6A: Design and Construction Schedule

## FACTOR 7: SMALL BUSINESS SUBCONTRACTING PLAN

### Price Proposal

The Phase 2 technical proposal, the Phase 2 ~~schedule~~ *price proposal* and any Phase 2 betterments accepted by the Government *and any final proposal revisions* will be made a part of the design-build contract.

### 3. METHOD OF PROPOSAL EVALUATION

Proposal evaluation is an assessment of the proposal and the Offeror's ability to perform the prospective contract successfully. The Government will evaluate proposals and then assess their relative qualities solely on the factors and subfactors specified in the solicitation. The relative strengths, deficiencies, significant weaknesses, and risks of each proposal will be documented by the Government.

Cost or price evaluation. In Phase 2, price or cost to the Government will be evaluated and considered but will not be scored or combined with other aspects of the proposal evaluation. The proposed cost or price will be analyzed for reasonableness. It may also be analyzed to determine whether it is realistic for the work to be performed; reflects a clear understanding of the requirements; and is consistent with the Offeror's technical proposal. Additionally, for fixed price contracts, all offers with separately priced line items or sub line items will be analyzed for unbalanced pricing.

Quality. The quality of the product or service is addressed in every source selection through consideration of one or more non-cost evaluation factors. The non-cost factors and significant subfactors that apply to this acquisition are identified herein.

Relative importance of cost/price to other factors.

Award will be made to that offeror whose proposal contains the combination of those criteria offering the best overall value to the Government. This will be determined by comparing differences in the value of non-cost technical and management features with differences in cost to the Government.

**In making this comparison, all evaluation factors other than cost or price, when combined, are approximately equal to cost or price. The Government is concerned with striking the most advantageous balance between technical and management features and cost to the Government.**

The degree of importance of cost could become greater depending upon the equality of the proposals for the other non-cost evaluation factors. Where competing proposals are determined to be substantially equal, cost factors would become the controlling factor.

Risk Assessment. The current type of risk evaluated as part of this source selection process is proposal risk. Proposal risks are those associated with an Offeror's proposed approach in meeting the requirements of the solicitation. It is an assessment that is integral to the evaluation of technical merit for each factor or subfactor.

#### 4. SELECTION & AWARD

**The Phase 1 selection process resulted in the selection of not more than three firms for the opportunity to offer proposals for the Phase 2 selection process. Award of a Design-Build contract will be made to one of the firms which, in the judgement of the Contracting Officer, represents the best value to the Government. The Government reserves the right to make award to other than the lowest cost offeror, price and other factors considered.**

5. Not used.

#### 6. EVALUATION FACTORS PHASE 2:

The evaluation factors and subfactors to be used to determine the merit of technical proposals and the relative weights assigned to the factors and subfactors are listed below.

Major evaluation factors and their subfactors are described below. Factor 6 (SCHEDULE) and Factor 7 (SMALL BUSINESS SUBCONTRACTING PLAN) are equal in importance. Factor 4 (OFFEROR'S DESIGN APPROACH WITH CONCEPTS AND SYSTEMS) is 6 times the importance of Factor 6. Factor 5 (MANAGEMENT APPROACH) is 2 times the importance of Factor 6. Subfactors 4A, 4B, 4C, 4E, 5A, and 5B are of equal importance and each is approximately ½ importance of Subfactor 4D.

The proposal will be evaluated in the following manner:

- 1- District Staff and Hill AFB Staff will perform a compliance review of Factor 4 code and RFP requirements. Specs/Narratives/drawing content will be evaluated with respect to subfactors and Paragraph 7 of Section 00110.
- 2- SSEB will then review all factors for merit and quality in accordance with the RFP. ~~During this phase, each offeror will provide an oral presentation for Factors 5 and 6.~~
- 3- Continued discussions and responses as ~~appropriate~~ **necessary**.
- 4- SSEB will perform a best value analysis.

#### **FACTOR 4: OFFEROR'S DESIGN APPROACH WITH CONCEPTS AND SYSTEMS (SUBMIT IN BINDER "A")**

Subfactor 4A: CIVIL

Subfactor 4B: ARCHITECTURAL/LIFE SAFETY

Subfactor 4C: STRUCTURAL

Subfactor 4D: MECHANICAL/PLUMBING/FIRE PROTECTION

Subfactor 4E: ELECTRICAL

*Evaluation (applicable for all Factor 4 subfactors): For Offeror's Design Approach with Concepts and Systems, the following will be reviewed against compliance with the technical requirements of the RFP:*

	CIV	ARCH	STRU	MECH	ELEC
1. Demonstrated understanding of the project design/build requirements.	X	X	X	X	X
2. Demonstrated ability to fully define the project and provide project solutions in terms of concepts, systems, and specific manufacturer product information.	X	X	X	X	X
3. Submitted documentation for clarity, understanding, and conformance with the RFP and amendments.	X	X	X	X	X
4. Life-cycle costs analysis for completeness, reasonableness, and correctness.				X	X
5. Environmental quality and compliance.	X			X	X
6. Fire safety and life safety provisions.		X		X	X

*Evaluation (applicable for all Factor 4 subfactors): For Offeror's Design Approach with Concepts and Systems, the following will be reviewed in a design competition scenario:*

	CIV	ARCH	STRU	MECH	ELEC
<i>Functional arrangement of project site.</i>	X				
<i>Architectural compatibility with adjacent facilities.</i>		X			
<i>Suitability and compatibility of materials.</i>	X	X	X	X	X
<i>Suitability and compatibility of production equipment.</i>		X		X	X
<i>Functional arrangement of building space.</i>		X			
<i>Sustainable design/greening.</i>		X		X	X
<i>Durability of materials.</i>	X	X	X	X	X
<i>Serviceability (All features)</i>					
<i>Maintainability &amp; Accessibility</i>		X		X	X
<i>Spare Parts</i>					
<i>Turn-around time</i>		X		X	X
<i>Staged location</i>		X		X	X
<i>Location of authorized repair centers/firms</i>		X		X	X
<b><i>Future expansion capability (dog house).</i></b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>

**FACTOR 5: MANAGEMENT APPROACH (ORAL PRESENTATION AND SUBMIT IN BINDER “B”)**

Subfactor 5A: Key Personnel

*Evaluation: For Key Personnel, the following will be reviewed:*

1. *Compliance with all solicitation requirements.*
2. *Proposed key personnel have the necessary knowledge, skills, and abilities to perform their duties in a manner which will ensure successful contract completion; as evidenced by their relevant experience, education, specialized training, and professional registration, as applicable. Applies to:*
  1. *Overall Design-Build Coordinator*
  2. *Design PM*
    - a. *Lead Architect*
    - b. *Lead Civil Engineer*
    - c. *Lead Structural Engineer*



- d. *Lead Mechanical Engineer*
  - i. *Fire Protection Engineer*
- e. *Lead Electrical Engineer*
  - i. *Lighting Specialist*
- 3. *Construction PM*
- 4. *Construction Project-site Superintendent*
- 5. *Construction Project-site Quality Control Representative*
- 6. *Construction Project-site Safety Manager*
- 3. *Equipment/Systems Supplier Key Person (an individual per firm) education, licensing/registration, and experience with past projects of similar equipment requirement. Applies to:*
  - 1. *DMB system.*
  - 2. *Telecrane system.*
  - 3. *Centralized Chemical tank/pump*
  - 4. *High Pressure Wash Equipment*
  - 5. ~~*Wash Water Recycle System*~~
  - 6. *De-Ionized water System*
- 4. *The evaluation will also encompass an assessment of proposal risk.*
- 5. *[Caution: Responses which are generic, vague, or lacking in detail may be downgraded.]*

Subfactor 5B: Quality Control

*Evaluation: The information provided in response to this subfactor will be evaluated in terms of the degree to which it demonstrates that the Offeror has a clear understanding of the quality control requirements of the solicitation and the degree to which it demonstrates that the Offeror has a sound approach to quality management. The evaluation will also encompass an assessment of proposal risk. [Caution: Responses which are generic, vague, or lacking in detail may be downgraded.]*

**FACTOR 6: SCHEDULE (~~ORAL PRESENTATION AND SUBMIT IN BINDER~~  
"B")**

Subfactor 6A: DESIGN AND CONSTRUCTION SCHEDULE

*Evaluation: For Offeror's Design and Construction Schedule, the following will be reviewed:*

- 1. *Content, logic, and reasonableness.*

2. *Phasing and scheduling of critical activities in achieving completion of the project within the overall specified period with minimum disruption to the surrounding facilities.*
3. *Critical path.*
4. *Task durations.*
5. *Layout of the entire project schedule from Notice To Proceed to Project Turnover and financial closeout.*
6. *Content related to inclement weather construction criteria.*
7. *Material submittal process --- per instructions herein.*

**FACTOR 7: SOCIO-ECONOMIC CONSIDERATIONS (SUBMIT IN BINDER  
"B")**

**Subfactor 7a: Participation of Small Business Concerns, Historically Black Colleges and Universities, and Minority Institutions (SBC/HBCU/MI)**

Evaluation: Consideration will be given to the following:

1. *--The extent to which proposed small business concerns (SBCs) and historically black colleges and universities and minority institutions (HBCU/MIs) are specifically identified by name by the Offeror;*
2. *--The extent of commitment by the Offeror to use the specifically identified firms, whether as a joint venture, teaming arrangement, or subcontractor;*
3. *--The complexity and variety of the work the identified firms are to perform.*

**Subfactor 7b: Small Disadvantaged Business (SDB) Participation (limited to the participation of SDB concerns in the performance of the contract under the Authorized NAICS Codes and for construction, by SDB concerns located in the Authorized Regions):**

Evaluation: Consideration will be given to:

1. *--The extent to which SDB concerns in the authorized NAICS codes and in construction regions are specifically identified;*
2. *--The extent of commitment to use SDB in the authorized NAICS codes and in construction regions concerns (for example,*

*enforceable commitments are to be weighted more heavily than non-enforceable ones);*

3. *--The complexity and variety of the work SDB concerns are to perform;*
4. *--The realism of the proposal;*
5. *--Past performance of offerors in complying with subcontracting plan goals for SDB concerns and monetary targets for SDB participation; in the authorized NAICS codes and in construction regions and*
6. *--The extent of participation of SDB concerns in terms of the value of the total acquisition.*

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

## 6. FAR 52.211-13 TIME EXTENSIONS (APR 1984)

Notwithstanding any other provisions of this contract, it is mutually understood that the time extensions for changes in the work will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of CONSTRUCTION. The change order granting the time extension may provide that the contract completion date will be extended only for those specific elements so delayed and that the remaining contract completion dates for all other portions of the work will not be altered and may further provide for an equitable readjustment of liquidated damages under the new completion schedule.

## 7. SAACONS 52.0211-4852 PERFORMANCE PERIOD (OCT 1992)

The required contract completion date equates to 02 August 2003 with ~~a Notice To Proceed (NTP) date of 31 July 2001~~ and a duration = 732 calendar days

## 8. SAACONS 52.0211.4853 WORK DAYS AND HOURS (APR 1992)

The normal work days and hours for this project will be Monday through Friday, excluding federal holidays, from 7:00 a.m. to 4:30 p.m. Access to the work site may be restricted to these hours and days. Work during other than normal hours and days must be coordinated in advance with the Administrative Contracting Officer.

## 9. FAR 52.215-19 NOTIFICATION OF OWNERSHIP CHANGES (OCT 1997)

(a) The Contractor shall make the following notifications in writing:

(1) When the Contractor becomes aware that a change in its ownership has occurred, or is certain to occur, that could result in changes in the valuation of its capitalized assets in the accounting records, the Contractor shall notify the Administrative Contracting Officer (ACO) within 30 days.

(2) The Contractor shall also notify the ACO within 30 days whenever changes to asset valuations or any other cost changes have occurred or are certain to occur as a result of a change in ownership.

(b) The Contractor shall--

(c) If this is a cost-plus-fixed-fee contract, the sum of the fixed fee and the incentive fee earned under this contract may not exceed the limitations in subsection 15.404-4 of the Federal Acquisition Regulation.

13. SAACONS 52.0219-4509 SUBCONTRACTING WITH SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESSES (OCT 1999)

Contractors are cautioned that failure of any Contractor to comply in good faith with the Contract Clauses titled (1) Utilization of Small Business Concerns or (2) Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan, when applicable, will be a material breach of contract. In order to assist contractors in developing a source list of small, small disadvantaged and/or women-owned small business concerns you are encouraged to contact your minority contractor associates, the local Minority Business Development Agency and the appropriate General Business Service Centers in your Standard Metropolitan Statistical Area. Contractors may obtain addresses of these sources from:

Write: US Army Engineer District, Sacramento  
ATTN: Contracting Division, Deputy for Small Business  
1325 J Street, 8th Floor  
Sacramento, California 95814-2922

Or Contact: **Ms. Michelle Stratton**  
Deputy for Small Business  
Telephone: (916) 557-5202

14. FAR 52.223-14 TOXIC CHEMICAL RELEASE REPORTING (OCT 1996)

(a) Unless otherwise exempt, the Contractor as owner or operator of a facility used in the performance of this contract shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106).

The Contractor shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.

(b) A Contractor owned or operated facility used in the performance of this contract is exempt from the requirement to file an annual Form R if --

(1) The facility does not manufacture, process, or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

(2) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

(3) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

(4) The facility does not fall within Standard Industrial Classification Code (SIC) designations 20 through 39 as set forth in 19.102 of the Federal Acquisition Regulation (FAR); or

**ATTACHMENT NO. 7****DRAWING FORMAT**

1.0 Policy: Drawings shall be prepared in accordance with the applicable provisions of the "A/E/C CADD Standards Manual" except as noted herein for title block/borders, drawing size, and file names. The A/E/C CADD Standards Manual is available for download at:

<http://tsc.wes.army.mil/Products/standards/aec/default.asp>.

2.0 Title and Border Sheets: Current, standard CADD title blocks and border files used by the Sacramento District for contract documents can be downloaded from: <http://www.spk.usace.army.mil/cespk-ed/cadd/AutoCAD/autocad.html>. See the drawings at the end of this attachment to clarify who and what titles should be shown in the title blocks including Drawn By, Designed By, Reviewed By, and Submitted By.

3.03.0 Drawing Size: The paper size for the drawings shall be 22 inches x 24 inches and Sacramento District border sheets reflect this size.

4.0 File Naming Convention: File names shall be as indicated at the end of this attachment. This is Sacramento District's interpretation of the current Tri-Service CADD standard.

5.0 Directory Structure: See the CADD Directory Structure listing at the end of this attachment for an example of the recommended organization of electronic files delivered to the Sacramento District.

6.0 Reference files: Make sure all reference files are attached without device or directory specifications (ie, relative pathing or just the xref filename). All reference files should be located in a separate XREF directory.

7.0 Level/layer convention, line symbologies, font libraries, and color/pen tables: The Architect-Engineer will use the AIA version of the CADD level/layer convention, line symbologies, font libraries, and color tables as indicated in the current version of the Tri-Service A/E/C CADD Standards Manual.

8.0 Hard copy data to be included: Existing hard copy data to be included in construction drawings shall be scanned to raster format (however vectorized is preferred) and incorporated into the electronic files or may be included as references following the reference file paragraph above.

9.0 PLOT CONFIGURATION DOCUMENTATION: The plot configuration file for each drawing shall be provided. This ascii text format documentation shall include the plotter configuration (e.g., name and model of plotter, pen settings, colors, widths, drawing orientation, drawing size, and any other special instructions). Acceptable plot configuration or plot documentation files are: \*.pcp, \*.pc2, or \*.pc3.

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## SECTION 01011 SPECIFIC ENGINEERING AND DESIGN CRITERIA

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## 1. NARRATIVES ON AREAS AND FUNCTIONAL REQUIREMENTS

The following narratives are included to aid the Contractor in understanding the requirements of the functions to be located in the C-130 Corrosion Control Facility. This project shall meet the criteria specified in the Air Force Handbook 32-1084, Facility requirements.

### 1.1 Description of Proposed Construction

#### 1.1.1 General

1.1.1.1 For this facility, The C-130 Corrosion Control Facility is a single level three-bay of approximately a total of 6,900 M<sup>2</sup> of all new construction located near the flight line at Hill AFB. The facility's primary function will be to provide an environmentally safe facility to perform depot-level corrosion control on C-130 and smaller aircraft. The facility shall support the periodic depot maintenance as well as the annual recurring drop-in C-130 aircraft.

1.1.1.2 The building will be permanent construction of concrete foundation and floor slab, clay brick or concrete masonry unit walls six feet above finish floor and a steel building including roof. The project shall contain aircraft docks (aircraft fitting entirely within hangars) for de-painting (stripping), washing, and painting. In addition, administration space, production support areas, building support areas, and special support areas shall be provided. The facilities shall meet current Environmental, Bio-Environmental, and Safety requirements as well as meet the users needs to process planes in a quality and timely manner.

1.1.1.3 All hangar bays shall be designed to have the aircraft pulled nose **or tail** first into the bays.

1.1.2 Sustainable Design: Sustainable Design (Green Design) is required for this project. ETL 00-1: EPA Guideline Items in Construction and Other Civil Engineering Specifications provides basic criteria and information pertaining to the incorporation of sustainable design concepts in the design and construction and can be accessed at <http://www.afcee.brooks.af.mil/eq/programs/progpage.asp?rbox=Fa>lse&type=program&groupcode=0&progid=27>

1.1.3 Demolition: Building 271 will be moved to a designated location and demolition of the foundations will be a part of this project. Surveys have been completed and no asbestos or lead-based paint containing materials was identified. The State Historic Preservation Officer (SHPO) has been notified by letter, dated 23 November 1998 and there are no known archeological or historic resources near the proposed site.

~~1.1.4 Future Expansion: The de paint, wash, and paint hangar bays shall be designed and constructed with the capability of future expansion considerations (not in contract). The structures shall be arranged on the site such that future expansion of 12,192 mm x 12,192 mm "doghouses" centered on the tow line of the aircraft will not adversely impact setbacks or surface and sub-surface features. Consider blackout in structural framing to allow opening in wall.~~

**1.1.5** Option Item: Daylighting feature shall be part of the design as an option and shall meet the following requirements as describe in LEED paragraph 2.0, page 23.

a. Achieve a minimum Daylight Factor of 2% (excluding all direct sunlight penetration) in 75% of all space occupied for critical visual tasks, excluding copy rooms, storage rooms, mechanical, laundry, mezzanine and other low occupancy support areas".

b. The contractor shall provide summary definition of building features that would change through modified elevation/cross section, building features such as lighting control, glazing type, automated window control, etc and expected change in energy consumption.

## 1.2 INTERIOR FINISHES AND MATERIALS

### 1.2.1 General

See Interior Design Finishes and Material Requirements paragraphs 2.7 for characteristics of items specified here.

### 1.2.2 Ceilings

Ceilings are to be 600 mm x 1200 mm (2' x 4') acoustical tile and should be specified in Administrative areas and painted gyp-board in restrooms, break rooms, locker rooms, storage and comm areas as appropriate. (see par. 2.7.8)

### 1.2.3 Corner Guards

Corner guards shall be located on all outside corners in corridors and other high traffic areas, and are to be vinyl integral corner guards.

### 1.2.4 Counter Surfaces and Cabinets

There are possible scenarios for the Break Rooms and Restrooms. Solid surface material with integral sink or plastic laminate with standard sinks could be implemented for the counter tops. The cabinetry shall be wood with a stain or plastic laminate.

### 1.2.5 Toilets

Toilet floors shall be ceramic tile with two or three color patterns for soil hiding and maintenance. Wainscots shall be glazed wall tile. Toilet partitions and urinal screens shall be solid polymer surface for durability and maintenance.

## 1.3 LANDSCAPE FEATURES (Not Used)

## 1.4 ELECTRICAL FEATURES

### 1.4.1 Electrical Substation

The power source for the new construction is existing outdoor substation #5. It is located North of building 238 in the general vicinity of parking lot near Southgate Drive. This substation will

require electrical modifications (narrated under paragraph 2.10.2.3, Site electrical and communications) to handle the loads imposed by new facility.

In addition to electrical modifications, Sub #5 will require limited structural modifications such as grading and extension of fence outward to accommodate placement of new transformer and switchgear. Existing ring ground grid will be modified to fit new concept. Extend at least two ducts from each switchgear cubicle to the first manhole for current and future 12kv feeder installation. D-B contractor and/or its agents shall field visit the substation site to collect as built data for execution of design modifications, compliant to applicable design documents.

#### 1.4.2 SUBSTATION TRANSFORMER\SWITCHGEAR

Provide one substation transformer with OA|FA, 55\65 degrees rise rating, sized to support new facility to include standard load growth factor but not exceeding 10 MVA. 44\12KV (primary\secondary) rated transformer shall have an automatic load tap changer on the secondary side. It shall also have two, 2-1/2 percent taps below and above normal on primary (44 KV) side.

A 15kv outdoor type, metal-clad switchgear with 4-feeder cubicles (2 feeders for this project and 2 spare) shall be installed.

#### 1.4.3 12 KV SERVICE MODE & UNDERGROUND FEEDER EXTENSION

D-B contractor shall provide loop-feed service mode for this facility, extending 2-12 kv feeders from new switchgear to parking area north of building 238, then along southgate, continuing along 6<sup>th</sup> street to project site and then terminating into three pad-mounted transformers (size to be determined based on life cycle cost analysis with best value for the government).

#### 1.4.4 PAD-MOUNTED TRANSFORMERS

Three pad-mounted transformers adequately sized to meet new facility load. It is intended that each bay loads will be served by a separate transformer whereas admin bldg loads will be put on the least loaded transformer of the three. Refer pad-mounted transformer paragraph under electrical requirements (para 2.10). A preliminary estimate indicates that facility load may exceed 5 MVA. Contractor shall make recommendations on the optimum size of transformers for this facility, considering all loads **and** harmonics. ~~and future facility expansion to include doghouses (1 to 3 protrusion in the southern wall of the facility to accommodate the nose of aircraft).~~

**(All requirements for aircraft larger than a C-130 have been eliminated)**

#### 1.4.5 Secondary Low Voltage Characteristics

The electrical service to the building will preferably be 480/277 volts, 3-phase, 4-wire to efficiently serve new lighting and large HVAC loads. Dry-type transformers will be provided to step down 480V to 208/120 for receptacles, small motors and other user equipment. K4-

factor rated with shielded isolation transformers shall be provided to serve computers and other sensitive equipment that produce harmonics, such as in the administrative areas and special environment repair rooms. Protection against external/internal generated transient surge voltage spikes shall be provided by Transient Voltage Surge Suppression (TVSS) units placed at the main switchboard and other strategic locations. Also refer to para 2.10.3 on Building Electrical for different low voltage service requirements.

#### 1.4.6 Interior Power Distribution

Electrical distribution panelboards will be of the circuit breaker type. Voltage drop will be limited to 3% for branch circuits, 1% for feeders, and 2% for service entrance conductors, with a 5% overall voltage drop limitation.

#### 1.4.7 Miscellaneous Equipment

Provide computerized controls for HVAC system in coordination with Mech features and (sectionalized) motorized doors for 3 hangars in accordance Architectural requirements.

#### 1.4.8 Receptacle

Receptacles in all hazardous occupancies shall comply with class 1, Div 1 or per NFPA 70's appropriate category and shall be mounted clear of hazardous classified areas inside hangars and other support areas. In other words NEMA 5-15R, 5-20R duplex receptacles shall be provided on 8 foot on centers and above 18" from the finished grade.

#### 1.4.9 Grounding

An insulated green grounding conductor shall be provided to each receptacle and in all other circuits. Grounding shall be provided as specified in NFPA 70 and MIL-HDBK-419A for grounding of panelboards and transformers. The earth electrode system shall be designed to obtain a resistance to ground of 25 ohms, except that the communications shall be 10 ohms, or less per MIL-HDBK-419A.

#### 1.4.10 Hazardous Occupancy

Major portion of the facility is dedicated to three bays, 1 bay will be used for painting the aircrafts whereas 2<sup>nd</sup> bay will be used for dry media stripping of the aircraft and 3<sup>rd</sup> bay will be used for washing the aircraft and the components. In some cases aircrafts may be full of fuel. The facility falls in Hazardous Occupancy category per NEC and NFPA. There will be use of paints and solvents in **paint** bay. In **DMB** bay there will be presence of combustible dust. D-B contractor shall be responsible for designing the electrical system to comply with all applicable articles of NEC (NFPA 70) and NFPA 101 for wet and hazardous occupancies including but not limited to Articles 500, 501, 502, 503, 513 and 516 of Special Occupancies of NFPA 70.

**Following is NEC applicability criteria for 3 bay project,**

**Paint Bay: Paint bay is required to paint fueled aircraft and shall comply with appropriate classifications of NEC.**

**Wash Bay:** Wash bay is required to wash fueled aircraft, ~~shall not have~~, and shall comply with appropriate classifications of NEC.

**DMB Bay:** DMB(strip) bay is not required to have fueled aircraft And shall comply with appropriate classifications of NEC.

**Following is NEC applicability criteria for 2 bay project (option)**

**Paint Bay:** Paint bay is required to paint fueled aircraft and shall comply with appropriate classifications of NEC.

**DMB\Wash Bay:** In this option DMB bay is required to be capable of aircraft washing and therefore must have a wash ventilation system, and must be dual rated for the DMB environment and for fueled aircraft.

#### 1.4.11 Communication System

There will be communications system installed in this project. Refer to communications requirements in paragraph 2.10.3.3 and 2.11.

#### 1.4.12 Fire Alarm System

Fire alarm system shall be designed per NFPA 72, 101 and all other applicable US Government standards. There shall be fire alarm in each bay.

#### 1.4.13 Day-lighting

Day-lighting application shall be considered for energy conservation and comforting lighted environment as described under interior lighting subparagraph 2.10.18.3.

#### 1.4.14 EMCS System

##### 1.4.14.1 EMCS Make-Up Requirements

1. All control system shall be direct digital control (DDC). All damper and valve actuators shall be electronic with a control signal of either 0-10 VDC or 4-20 ma. The DDC system shall be installed according to the following I\O summary chart for following mechanical systems:

- A. Chillers and associated pumps
- B. Boilers and associated pumps
- C. Air handlers and any associated VAV boxes
- D. Computer Room AC Units (CRAC)
- E. Exhaust fans
- F. Packaged heating\cooling equipment

**Note:** The EMCS is not required for any of the "process" HVAC systems in the aircraft bays. The EMCS is required only for the staff and administrative areas.

2. All building DDC for HVAC equipment shall be 100% compatible with the existing base-wide Energy Monitoring Control System (EMCS). The existing system is a Dorsett's INFO-SCAN/MicroScan system manufactured



by Dorsett's, Inc., 100 Woodlyn Drive, Yadkinville, NC 27055, Phone (800)331-7605.

**Project EMCS connections shall be made by the Contractor to the nearest Government furnished communication media e.g. telephone panel and/or data terminal cabinet. These connections shall link a modem, located in DDC equipment enclosure to GFGI communication media via a dedicated 4-wire circuit. All pair assignments will be furnished by the Government. Modem(4 wire output type) shall be integrated into the DDC equipment panel\enclosure by the DDC equipment manufacturer.**

The EMCS integration shall include complete installation of all hardware and software. This shall include but not be limited to an INFO-SCAN database conforming to the I/O schedule, INFO-SCAN dynamic graphic displays, and all applications programming necessary to accomplish the specified sequences of operations. All points required for operation shall be provided in software and hardware.

3. The Contractor shall perform a complete point to point test of the completed DDC\EMCS installation. The test shall be conducted by measuring each analog value with a test instrument twice as accurate as the device being measured. The test equipment shall be certified traceable to NIST standards. Each value shall be calibrated to the specified accuracy. All outputs shall be exercised on/off or full scale analog to verify operation of each channel and device. All digital inputs shall be tested by exercising the connected device such as freez-stat, smoke detector or differential pressure switch, with a simulated input condition. Pressure switches for filter status shall be calibrated to the specified pressure using a magnehelic gauge. All test results shall be recorded and documented by the contractor and included in the Operation and Maintenance manuals furnished to the Government.
4. The contractor shall provide a portable testing and troubleshooting device for use with the completed DDC\EMCS. The device shall be delivered to the EMCS operations Office in building 15 upon completion of system testing and training.
5. The contractor shall provide 8 hours of training for the building operations personnel. The training shall be performed after installation of the system is completed and tested. The training shall consist of instruction on the operation of system, maintenance of the system and troubleshooting problems associated with hardware and software. Instructions topics shall include operation of the portable test device and EMCS central installaion.
6. Contact Mr. Steve Nalder EMCS Operation's Manager at (801)777-3988.

#### **1.4.14.2 EMCS Performance Test**

**The Contractor shall test the installed EMCS to demonstrate that the installed system is fully integrated, fully compatible and communicates successfully with existing Basewide System. All necessary software and hardware shall be provided, installed and set-up by the Contractor, at no additional cost to the Government, to allow the new EMCS and the existing Basewide system to function properly as intended.**

After installation of project EMCS, Contractor shall notify the Contracting Officer that the installed EMCS is ready for Others to connect to the Basewide system. The Contractor shall then allow the government sixty (60) calendar days from such notification to make the necessary land-line connections between the Base's existing system and project EMCS.

The project EMCS shall have terminations in a data terminal cabinet. The Contracting Officer will notify the Contractor when the connections have been made. Upon receiving notice for further testing from the Govt., Contractor shall proceed to conduct final EMCS Performance Test.

Contractor shall notify the Govt, 7 days in advance; of both activities e.g. completion of project EMCS installation and beginning of EMCS Performance Test.

#### 1.4.15 Applicable Codes and Documents

All work shall be done per all applicable ANSI, NEMA, NFPA, UL, USAF, IEEE, EIA/TIA, NESC and other applicable documents including but not limited to technical references listed in "Section 01010 General Project Description And General design Requirements"; for US Government projects.

#### 1.4.16 Harmonics and Non Linear Loads

##### 1.4.16.1 Harmonics Producing Equipment and Separation

This project includes VFD(s) and other harmonics producing non linear loads, therefore the Contractor shall design low-voltage electrical system by separating and installing the harmonics producing non linear loads on an isolated low voltage bus connected to K-13 rated transformer and switchboard with doubled neutral size.

In any case, voltage distortion due to harmonics shall not exceed 5% per references of IEEE standard 519-1992. Also comply with other harmonics related requirements indicated in paragraph 2.10.8 for VFD(s).

##### 1.4.16.2 Harmonics Content Testing

Contractor shall conduct a final acceptance test in the presence of Contracting Officer or his representative, to demonstrate that harmonics distortion due to installed non-linear loads does not exceed 5%; using harmonic distortion test meter.

#### 1.4.17 Telecranes

The proposer shall provide electric power for three (3) telecranes in paint bay. The telecranes shall be provided with automatic emergency back-up power system(s) to support the critical functions at the telecranes including breathing air system if electrically powered. Back-up power system shall allow the lowering of cranes to ground level, in case of power loss. Also refer to paragraph 2.9.3.2 for more discussion.

#### 1.4.18 Emergency Power Switch for (roll Up Type) Motorized Doors

*All three bays shall have motorized doors. Opening and closing of these doors at demand, is very essential to successful operation of this facility. Therefore it is required that electrical system for motorized doors be designed to allow, manual transfer of power from normal to alternate source upon loss of power. End user shall provide its own generator (sized only) to supply back-up power for all motorized doors. Proposer is required to furnish a wall-mounted, outdoor type, completely wired emergency power switch per NFPA 70 for connection to emergency power source. AF base currently uses NEMA 3R power switch concept at other facilities, mounted at 4' AFF.*

#### **1.4.18 Variable Frequency Drives (VFD's)**

*The proposer may (as required by the application) provide VFDs for the process bay ventilation systems or subsystems where a VFD is applied to meet air flow requirements. Other ventilation systems which do not justify application of VFD's shall not have VFD's. The application of VFD's shall be based on sound value engineering to reduce first high cost of installation and maintenance thereafter.*

### 1.5 MECHANICAL FEATURES

#### 1.5.1 Process Equipment

The process equipment requirements stated in the body of this RFP are a minimum the industry is changing and new equipment will be considered.

#### 1.5.2 HVAC

The HVAC system will be designed and installed in accordance with ASRHAS standards. A design analysis and narrative with calculations is to be provided with sufficient detail to justify the design to the reviewers. The report is to include a life cycle cost and energy conservation features including active and passive solar, and buildings waste heat are to be considered. The main heat source is to be provided by natural gas. The use of waste heat is to be considered in the design. Building EMCS is compatible with the base wide EMCS.

#### 1.5.3 Plumbing

The plumbing system will be designed and installed in accordance with the National Standard Plumbing Code. A gas fired water heater will provide hot water to Showers, lavatories and janitors sinks.

##### 1.5.3.1 De-ionized water (*Option Bid Item*)

The paint hanger is to have de-ionized water capability. The de-ionized water system shall have a minimum storage capacity of 2000 gallons, with a maximum replenishment interval of the stored volume within 24 hours. Each of the four (4) hoses shall have a minimum delivery rate of fifteen (15) GPM. The water delivered by each hose shall be one hundred twenty (120) degrees F. The system shall provide de-ionized soft water maintained at 1 Meg Ohm, .5 PPM total dissolved solids (TDS).

#### 1.5.4 Fire Protection

The AFFF and wet pipe sprinkler systems shall be provided for the facilities. The design will be per Air Force ETL 98-7, and MIL-HDBK-1008C.

#### 1.5.5 Process Equipment

The process equipment for the facility shall be a dry media blast (DMB) with a recovery and capture system.

### 2. GENERAL DESIGN CRITERIA

#### 2.1 Site Layout and Design

##### 2.1.1 General

There are no access roads or POV parking spaces to be built under this project. Final design Drawings and Specifications for all site improvements shall be designed and stamped by a civil engineer registered in the State of Utah having at least five years experience.

##### 2.1.2 Handicapped Accessibility

There are no Parking spaces, sidewalks and ramps for the handicapped required for this project.

##### 2.1.3 Scope and Objectives

Site work shall consist of the complete design and construction of building site. The facility shall be completely useable with utility connections and other amenities as described in this document. Design shall take into consideration topography and natural characteristics of the area, including climatic conditions, prevailing winds, etc. It shall be the Contractor's responsibility to protect existing features, which include roads, trees, sidewalks, paving, curbs, and similar items not in the contract work limits. If damaged by the Contractor they shall be replaced, in kind at no cost to the Government. Site work and utility designs shall provide a functional design solution requiring only routine maintenance through its design life. Emphasis shall be placed on positive drainage away from the structure. Site planning, development and the Contractor's operations shall at all times take into consideration that other facilities bordering the site must remain fully operational during the performance of the work. Innovative, creative and/or cost saving proposals, which fulfill these criteria, are encouraged and will be evaluated accordingly.

##### 2.1.4 Topographic Survey

Topography is required as indicated in Attachment 25. The entire project includes the area bounded by the buildings 503, 505, 287, 286, 279, **275** and 265 shown in Attachment 8. The Contractor shall review and field verify the topographic survey information and be responsible for all additional survey(s) required to complete requirements of these documents.

- a) Project Survey Control. Topography shall tie into the existing horizontal and vertical control points on Hill AFB located near the project site.
- b) Protection of Monuments. Existing survey monuments, except where drawings call for demolition of specific monuments, shall be protected during construction from movement and damage. Damaged monuments shall be replaced, to the original order of survey accuracy, at no cost to the Government.

#### 2.1.5 Demolition

Demolition procedures, methods, sequence of operations, and equipment shall be in accordance with EM 385-1-1. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. The Contractor shall take necessary precautions to avoid damaging Government property, or if damage occurs, shall repair or replace the damage as directed by the Contracting Officer, at no cost to the government. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area.

- a) Project Demolition. Demolition of all features or items found on the site (pavement, fence, utilities, poles, monitoring wells, etc.) shall be considered incidental to the Contract. Title to material and equipment to be demolished, except historical items, is vested in the Contractor upon receipt of notice to proceed and the Government will not be responsible for the condition, loss or damage to such property.
- b) Demolition of buried features. Building 273 has been previously demolished. Concrete slab, foundation and underground utilities may be encountered when excavating for the ramp from the existing concrete apron to the project site. Demolition associated with this project will include the removal, in its entirety, of all such debris.
- c) A concrete slab is located on the site at the intersection of 6<sup>th</sup> Street and Engine Street. Demolition of this concrete slab under the base bid, shall include concrete slab, foundation and underground utilities. Sample soils adjacent to floor drains for contamination prior to disturbing the building. Included in this demolition work shall be various building appurtenances.
- d) Demolition and relocation of steam and pneumatic lines require maintaining service to existing facilities during construction. Demolition should be coordinated accordingly. The steam line can be out of service no longer than 48 hours. Service must be switched from old line to new line in less than 48 hours. It is highly desirable to have this switchover be done in summer months. There are no hazardous materials associated with demolition of the steam line. The pneumatic line must be moved if proper clearances to existing and new structures cannot be maintained otherwise.
- e) Existing utility services that do not need relocation shall be protected from damage. Coordinate and obtain locates for all buried utilities prior to beginning work. No existing utility service shall be located under any building footprint, nor shall they be abandoned in place. They shall be demolished and removed from the Base.

- f) Disposal of Solid Wastes. Soil, asphalt concrete and portland cement concrete shall be disposed of near the North Gate of Hill AFB. The Contractor shall be responsible for disposal of all other demolition debris, construction debris, and all solid waste offbase disposal at the Davis County Land Fill approximately 5 miles east of Hill AFB. Solid waste shall be placed in containers and disposed on a regular schedule. All handling, transport, and disposal shall be conducted in such a way as to prevent spillage and contamination in compliance with Federal, State, and Local requirements.
- g) The Contractor shall conduct demolition and removal operations to ensure minimum interference with streets, walks, or other adjacent facilities being used. Burning is not permitted on site.
- h) The Contractor shall ensure safe passage of persons around area of demolition and conduct operations to prevent injury to adjacent buildings, structures, and persons. The Contractor shall promptly repair damages caused to adjacent structures by demolition operations at no cost to the Government.
- i) Building 277 is located on the site, south of Building 275 and north of Building 287. It is a small bus stop sized structure. Demolition of Building 277, under the base bid, shall include the structure, concrete slab, foundation and underground utilities.
- j) ***Buildings 247 and 248 are located on the site, south of Building 265 and east of Engine Lane. If this area is required by site layout, the buildings shall be removed by others prior to the construction commencing in the area. Demolition of Buildings 247 and 248, under the base bid, shall include only the concrete slab, foundation and underground utilities.***

#### 2.1.6 Monitoring Wells

Environmental Management Directorate Restoration Division(EM) phone (801)777-2050 or pager (801)396-2023 has information about existing monitoring wells. The active groundwater monitoring well located at 283828.95 North and 1870063.19 East may be abandoned. Coordinate with EM through the Contracting Officer to abandon and inert old monitoring wells that are in the area. Most likely, three wells will be affected. The actual number depends on final placement of the C-130 Corrosion Control Facility. The Contractor shall provide the facility footprint to the Contracting Officer who will coordinate with EM. EM will identify affected wells, and EM will abandon wells on a schedule coordinated with the Contractor.

#### 2.1.7 Siting

The site layout and design shall meet the minimum provisions of all applicable references indicated in these RFP documents. The Contractor shall confine proposed development to the project area as designated in these RFP documents. The proposed C-130 Corrosion Control Facility site is bordered by Building 279 to the west; 6<sup>th</sup> Street to the south; Buildings 287 and 286 and existing concrete apron area to the east; and Building 265 to the north. The site limits are shown on the plan

in Attachment 8. **Any facility and pavement configuration or orientation meeting the functional requirements of this RFP shall be permitted. Any configuration of hangers may be utilized i.e. contiguous hangers forming any shape("L", "U", staggered), separate structures or combination of both.**

- a) Site improvement locations and configurations shall conform to the general requirements as described in these RFP documents.
- b) Southern site limits: Provide a minimum of ~~18~~ **6** meter setback from the north edge of pavement on 6<sup>th</sup> Street. ~~This is to allow for future expansion on the south side of the C-130 Corrosion Control Facility buildings. The expansion would include an area approximately 12 x12 meters centered on the tow line of the aircraft for each hanger. Outdoor equipment shall not be placed in these areas to facilitate the expansion at a later date.~~
- c) Northern site limits: **Buildings 247 and 248 shall be moved if proposers find utilization of these areas advantageous to the site layout. Buildings 265 and 275 define the northern limits of the site. Provide setbacks that meet all Hill AFB fire and safety requirements. No future development (hangers) is planned for this site. Entire site limits may be utilized for this project which consists of two hangers and an optional wash hanger.** ~~Along the north side of the site limits additional hangers requiring access to the concrete apron to the south may be sited. Site configuration should make allowances for this possibility of future development. The site limit shown in Attachment 8 represents the most northerly edge of pavement for the project.~~
- d) Eastern site limits: The concrete apron area for the project must be connected to the existing concrete apron to the east in order to allow planes to access the C-130 Corrosion Control Facility. ~~A 65 foot wide tow lane must also be maintained~~ **Provide setbacks that meet all Hill AFB fire and safety requirements for structures** along the remainder of the eastern side of the site.
- e) Western site limits: ~~A 65 foot wide tow lane must also be maintained between the loading dock connected to Building 279 and the new hangers that are part of this project (see Attachment 8).~~ **Engine lane may be blocked and the area utilized as part of the site. Provide setbacks from Building 279 that meet all Hill AFB fire and safety requirements.**
- f) **Wash Hanger (Option bid item): Show siting of wash hanger. The option shall include any pavement, outside utilities and/or connection to utility stubouts from the other hangers in the base bid, that are required to make this hanger functional.**

#### 2.1.8 Pavement

Concrete pavement is required in aircraft areas used **for towing, turning, and parking C-130 aircraft.** The concrete pavement thickness shall be as indicated in Attachment 9 **24**, titled Geotech **Report for Airfield Pavement** Requirements Criteria. The paragraph titled "C-130 STRETCH" shall be used for the base bid **concrete** pavement. **Other areas may be flexible pavement as indicated below.** ~~Option #8 requires~~

~~placement of pavement for four other aircraft. The paragraph titled "KC 135, C 130 Stretch, F 16 and A 10" shall be used for the preparation of this option.~~ **Pavement striping is required as indicated in Attachment 8, sheet C2.7.**

Provision shall be made for towing the aircraft into **and out of** the hangers. **Turning radius requirements for the C-130 are indicated in Attachment 8, sheet C2.7.** The tugs doing the towing shall be able to pull through the hangers and exit the opposite side of the hangers. Asphalt (**flexible**) pavement is permitted for areas where only tugs are permitted **and for shoulder areas not subjected to C-130 pavement loading.** ~~These areas shall be designed for H 20 loading and shall be a minimum of 12 feet in width. Pavement shall extend from the point that tugs exit the hangers to the point of connection providing access to the apron area and shall be a minimum of 12 feet in width. north edge of 6<sup>th</sup> Street. AC pavement areas shown on Sheet C2.6 shall be designed for H 20 loading.~~ **Flexible pavement section shall be as indicated in Attachment 24, titled Geotech Report for Airfield Pavement. The paragraph titled "C-130 STRETCH" shall be used for the flexible pavement.** In every area where existing pavement is disturbed, either from building construction, pavement installation or due to construction operations, this pavement shall be replaced with an asphalt pavement section designed for H-20 loading. Sawcut existing pavement as required to provide a good joint and smooth transition from existing pavement elevation to the project building or pavement being transitioned to. Transitions shall be graded as required to provide slopes not exceeding 5 percent.

#### 2.1.9 Drainage

All sloping of floors must be such that there will be no standing water. This includes the access up to the doors of the wash bay. In every case the exterior grade should either be away from the facility or else have a drain which removes water.

Minimum slope of concrete pavement shall be one-half of one percent. Minimum slope shall be five percent for the first 10 feet for other surface materials around the building. Tow lane and apron shall slope at a maximum of one percent. Short term slopes of up to two percent are permitted as required to transition to existing pavements whose elevations shall be matched. All drainage from the tow lane shall flow away from the purge dock.

## 2.2 Earthwork

### 2.2.1 General

During construction, minimize disturbed areas, stockpile excavated soils, and protect excavated soils from wind and water erosion. Replace or remove soils when construction is complete.

### 2.2.2 Excavation

Cuts to a depth of several feet may be required by slope criteria to transition from the elevation of the existing concrete apron to the project site.

- (a) Coordinate with the Environmental Management Directorate Restoration



Division(EM) through the Contracting Officer on all soil excavations deeper than six feet.

2) EM has logistical and financial responsibility for disposal.

(b) through (c) was deleted.

(d) The contractor shall develop a health and safety plan that prepares them to react safely and immediately when they encounter contamination at the site.

(e) Contaminated soil has been reported at boring location 2F-00-3 on the project site. The type of contamination suspected at this location on the project site is indicated in the attachments. The Contractor shall contact the Contracting Officer seven (7) calendar days before the start of any work at boring location 2F-00-3. The Contractor shall excavate the contaminated soil at boring location 2F-00-3 transport the material to another location on base (within 7 miles of site) at the direction of the contracting officer and place the contaminated soil in a roll-off container (with sides approximately 3 meters high) provided by the Base. The Contractor shall consider the volume of contaminated soil to be 10 cubic meters. Volumes in excess or less will be handled by contract modification.

(f) If the contractor encounters other soil on this project site that the contractor suspects to be contaminated as a result of suspicious odors or discoloration, the contractor shall immediately stop work at the site of the contamination and immediately report this situation to the Contracting Officer to allow the Government to sample and test; work stoppage shall be up to 3 days for testing. The contractor shall be prepared to excavate and transport said contaminated soil to another location on base (within 7 miles of site) at the direction of the contracting officer and place the contaminated soil in a roll-off container (with sides approximately 3 meters high) provided by the Base. All encounters, other than boring location 2F-00-3, will be handled with a contract modification.

#### 2.2.3 Borrow

All borrow shall be obtained off base at Contractor expense.

#### 2.3 Geotechnical Design

The Contractor shall secure the services of a competent and reputable Geotechnical Engineering consulting firm to provide the basis of design for foundations, retaining walls, grading, earthwork and all other geotechnical related design and to provide engineering support during construction. Pavement section design is provided in Attachment #9 24. The geotechnical engineering effort and scope of field and laboratory testing shall be commensurate with the scale and complexity of the project. Bearing capacity and settlement calculations shall be provided for shallow and deep foundations as required by site conditions. The Geotechnical Engineering firm shall be familiar with seismic, geologic and geotechnical conditions, hazards and issues in the region, i.e. Geomorphic Province, where the project is located. The Geotechnical Engineering firm shall have at least five (5) years experience in the region. All engineering work products shall be reviewed and approved by a Senior Civil or Geotechnical Engineer of the firm who has been registered for at least five (5) years in the State of Utah.

The Geotechnical Engineering firm shall prepare and submit a Final Geotechnical Report through the Contractor to the Government. The Final

Geotechnical Report shall be submitted for Government approval and shall include recommendations and design parameters necessary to support the project design. The Final Geotechnical Report shall be based on site and project specific explorations, (drill holes and or trenches) and field and laboratory testing.

All field and laboratory work shall be conducted in accordance with appropriate ASTM standards; refer to the current Annual Book of ASTM Standards, Section 4, Construction, particularly Volume 04.08 Soil and Rock (I) and Volume 04.09 Soil and Rock (II); Geosynthetics. The Contractor shall include drawings, showing the actual exploration locations and depicting the subsurface conditions encountered at the project, with the project design drawings. A set of the drawings shall be included in the design drawing set and a separate set of drawings shall be provided; thus two sets.

If in the opinion of the Government, the Final Geotechnical Report and geotechnical basis of design does not meet the standards indicated by the applicable Engineer Manuals, Technical Manuals, and ASTM's, or is otherwise incomplete or in error, the Contractor shall have the Geotechnical Engineering firm provide additional information, testing and explorations as required by the Government. The additional work and analyses required by the Government to support the project design shall be provided by the Contractor at no additional cost to the Government.

In addition to the usual submittal copies provided the Government, one (1) copy of the Final Geotechnical Report shall be mailed under separate cover to the Sacramento District, Soil Design Section. The copy sent to Soil Design Section is for compliance review. Mail a report copy to USAED, Sacramento, 1325 J Street, Sacramento, Ca. 95814, Attn: CESPK-ED-GS.

Contractor shall coordinate site explorations with the Base through the Contracting Officer. The Base may elect to obtain additional soil samples dependent on and during the Contractor's site explorations.

Foundation design shall conform to Base Facility Standards.

## 2.4 Utilities

The proposed site has numerous existing utilities that must be addressed during planning and facility siting design. These utilities shall be protected in place at all times. Protect existing utility lines when new pavements are constructed above them. When the depth of cover over utilities, structural load etc. is changed then the utilities shall be redesigned for the altered conditions. Existing utilities may be relocated to the extent necessary or required by project design. New or existing utilities shall not encroach upon, interfere with, or otherwise impact existing facilities or new structures. Existing utility drawings included in Attachment 8 are for information only. Main lines and not service laterals are shown. Proposers must verify the accuracy of this information and show their findings in their design submittals.

Installation of any utility that requires crossing of existing streets or other paved areas or sidewalks shall be performed by saw cutting and patching existing asphalt or concrete. Patching shall restore asphalt concrete or concrete to existing lines and grades prior to construction. Provide traffic control as required to provide minimal disruption to traffic. Work shall be scheduled such that no more than one-half of the roadway is closed at any one time. Maintain all safety

practices for both day and night work. Provide steel traffic plate cover over night work. Contractor shall make diligent effort to develop short and systematic utility runs to the project site. The Contractor shall coordinate with the Base through the Contracting Officer for approval of all scheduled utility work prior to commencing excavation for scheduled work. Minimize impact to Base personnel and facilities. Any crossing of South Gate Avenue shall be performed only by boring and jacking with conduit sleeves; no cutting of this street shall be allowed.

Regarding utility line laterals, Offerors shall assume that each existing building has a complete set of service utility laterals namely water, power, steam or gas, sanitary sewer, industrial waste, roof drain lines to storm drain system for roofs with parapet walls, and communications. The Contractor shall address and cross these lines if his excavation is between the building and applicable utility main. After award, the Offeror shall research record drawings at the Base Civil Engineer's Office to determine locations of lateral utility lines in the project area and apply the information to the design and construction of the project and show the information on the project drawings. In addition, after award of the contract the Contracting Officer will surface-mark all underground utility lines active and inactive (with noting active status) in the applicable excavation areas as requested by the Offeror.

#### 2.4.1 Pneumatic Tube

See sheet C2.4 in Attachment 8 for approximate location of the pneumatic tube. Show desired relocation route of the utility. Maintain setbacks and/or clearances consistent with existing field conditions for the utility.

#### 2.4.2 Gas Line

Connect to the gas manifold at Building 501 to supply gas for the project site. This building is located on the east side of Southgate Avenue and just south of where 6th Street hits Southgate.

#### 2.4.3 Compressed Air Line

A compressed air line runs down the west side of A Lane between two manholes. One manhole is just east of Building 265 and the other is west of Building 295 near a steam manhole (see sheet C2.8 in Attachment 8). The line is a 6 inch diameter steel line with approximately 1-1/2 feet of cover. The cover may be further reduced as a result of the grading required for the tow lane. The portion of the line that crosses beneath the new concrete tow lane shall be relocated and/or protected as required. Protection shall include reinstalling the compressed air line inside a sleeve/culvert designed to withstand the loading of the aircraft operating on the tow lane. The sleeve/culvert shall also facilitate future repair of the compressed air line without removing concrete pavement (tow lane).

#### 2.4.4 Steam Lines

##### 2.4.4.1 General Requirements:

- 1) All steam and condensate laterals must be returned to service after installation of mains as required (the existing underground lateral to Bldg 505 is inactive/capped and may be either abandoned or removed).
- 2) Contractor shall set up a schedule to minimize outages especially Bldg 505. There shall be no steam outages between 15 October and 31 March. The Davis County line is shut down in August.
- 3) Contractor shall coordinate all outages with the Contracting Officer.
- 4) Contractor shall notify the Contracting Officer a minimum of 30 days in advance of all outages.
- 5) All isolations valves shall be gate valves (check valves shall not be used for isolation).
- 6) Contractor shall demolish/remove all existing steam line & stanchions that are no longer required. The contractor shall remove or fill in all abandoned manholes.
- 7) Steam piping shall be designed in accordance with TI 810-32. The working pressure for the piping is 689 Kpa (100 psi). The construction of the new overhead and in trench steam lines, and the connection to the existing, shall be in accordance with military guide specifications CEGS 02553 (Heat Distribution Systems In Concrete Trenches) and CEGS 15080 (Thermal Insulation of Mechanical Systems). CEGS 15080 and CEGS 02553 are U.S. Army Corps of Engineers guide specifications for construction.
- 8) See steam line relocation drawing sheet C2.8 in Attachment 8 for general information. ***Use this drawing to the extent required to facilitate the proposer's site layout. For example, if no steam lines are impacted by the site layout then none of the relocation shown is required. The following information in paragraphs 2.4.4.2, 2.4.4.3, and 2.4.4.4 shall only be used to the extent required to facilitate the proposer's site layout.***

#### 2.4.4.2 Steam Line Runs:

- 1) Relocate the Davis County Steam Supply line:

Existing: Presently there is a 14" overhead Davis County Steam Supply line that runs through the project site.

New Work Required: Relocate the portion of the above ground 14" Davis County Steam Supply that runs between a point near the SE corner of Bldg 279 and where the pipe goes underground near the intersection of 6th Street and A Street.

- (a) The new route starts at the 14" line at the connection at Bldg 279 then it runs south to the north side of 6th street and then east to make connection at the point where the pipe goes underground near the intersection of 6th Street and A Lane. There are no valves in this line.
- (b) The contractor shall replace existing traps and discharge condensate into new french drains.

- (c) After running the new steam main, contact the Contracting Officer for outage, and then make connections.

2) Relocate HAFB steam distribution piping:

Existing: Presently there are two HAFB distribution mains running through the project site. One is a 10" underground steam main running from the boiler plant(Bldg 260) to Bldg 510 that follows the Davis County Steam Pipe. The other one is a 12" overhead steam line running from the boiler plant(Bldg 260) to a cross connection joining the overhead system and the underground mains together. After the cross connection this overhead steam line reduces to 10" and runs south to Bldg 505. These two existing steam mains are to be replaced with a single 16" overhead steam main between a point near the SE corner of Bldg 279 and the branch line running to Bldg 505. After the branch connection to Bldg 505 reduce the new steam main to 10" and run to a new manhole at the corner of 6<sup>th</sup> Street and 'A' Lane.

New Work Required:

- (a) Construct a new manhole to intersect the 10" underground steam main near the SE corner of Bldg 279 to include steam trap. The purpose of the manhole is provide a connection point to connect the new 16" overhead steam line to the existing underground 10" steam distribution line
- (b) Construct a new 16" aboveground main between the SE corner of Bldg 279 to the existing 10" branch connection on the north side of 6<sup>th</sup> St that feeds Bldg 505. This new main to run parallel with the relocated Davis County Steam line. At the north end (near Bldg 279) provide a 16"x16"x16" tee. Reduce the 16" branch connection to 10", provide a 10" gate valve, run 10" piping down into the manhole, and make preparations for the connection to the underground steam main. Reduce the 16" straight run to 12", provide a 12" gate valve, and make preparations for the connection to the existing 12" overhead steam main. At the other end of the new 16" steam main (north of Bldg 505 on the north side of 6<sup>th</sup> Street) provide a 16"x16"x16" tee. Reduce the straight run to 10", and install a 10" gate valve. Reduce the branch run to 10", install a 10" gate valve, and make preparation to connect to the branch line running to Bldg 505.
- (c) Construct a new manhole to intersect the 10" underground steam main and 6" condensate main near the intersection of 6<sup>th</sup> Street and 'A' Lane. The purpose of the manhole is provide a connection point for the new 10" steam distribution line and the new 6" condensate main.
- (d) Construct a new 10" above ground main between 10" gate valve (at the Tee for Bldg 505) and the new manhole near the intersection of 6<sup>th</sup> Street and 'A' Lane. Drop the 10" main into the manhole and make preparations for installing a new 10" x 10" x 10" Tee to tap into the existing underground 10" line. The existing 10" underground steam main will need to be capped north of Bldg 287.

### 3) Relocate condensate main piping:

Existing: Presently there is a single 6" above ground condensate main running from a point near the intersection of 6<sup>th</sup> Street and 'A' Lane back to the boiler plant(Bldg 260).

New Work Required: The existing condensate main is to be replaced with a new 6" overhead condensate main between the new manhole near the intersection of 6<sup>th</sup> Street and 'A' Lane and near the SE corner of Bldg 279. The new condensate main shall follow the path of the relocated Davis County steam line.

- (a) Construct the new 6" overhead condensate main between the new manhole near the intersection of 6<sup>th</sup> Street and 'A' Lane and to a point near the SE Corner of Bldg 279. Install a 6" tee in this line for connection to the condensate line from Bldg 505.
  - i. In the manhole near 6<sup>th</sup> Street and 'A' Lane make preparations to connect to the existing condensate main. At time of connection a Tee will need to be installed in the existing condensate main and the existing overhead condensate main will need to be capped north of Bldg 287.
  - ii. At the 6" tee provide two 6" gate valves. One in the condensate main coming from the manhole and the other in the branch line coming from Bldg 505.
  - iii. At the north end near the SE corner of Bldg 279 make preparations for connecting to the existing 6" overhead condensate main.

### 2.4.4.3 Steam Traps: Install new steam trap assemblies as needed:

#### 2.4.4.4 Outages:

- (a) Steam & Condensate Serving Bldg 505. After all the new steam distribution piping, condensate mains and steam traps have been installed, make the Bldg 505 transfer as the first completed connection.
- (b) Steam & Condensate Serving Bldg 510 and other buildings on 'A' Lane and Lahm Lane: The change over for these other building shall be made immediately following the Bldg 505 change over.

## 2.5 Landscape Architectural Features

There are no requirements for landscaping around the proposed facility.

## 2.6 Architectural

### 2.6.1 General

- 2.6.1.1 Construction for the facility shall be as described in these documents. The building shall be constructed of noncombustible construction according to the Uniform Building Code. **The hangar bay may be separate independent building (see also para. 2.1.7). Fabric walled buildings are not acceptable.**

- 2.6.1.2 The architectural theme of the building shall complement existing or current construction in the site area. Primarily, exterior walls shall be cmu/metal siding with structural standing seam metal roof and shall conform with Hill AFB Architectural Compatibility Standards.
- 2.6.1.3 The building shall be located in an existing area bounded by Building 265 on the north, Building 279 on the west, Building 503 and 505 on the south and Building 295, 286, 287 and a concrete pad on the east. The area is mainly asphalt with existing overhead steam lines and pneumatic lines to be relocated as part of this project.
- 2.6.1.4 The C-130 Corrosion Control Facility's three hangar bay interior shall allow a horizontal and vertical clearances as describe in paragraph 2.6.4.2.
- 2.6.1.5 Design buildings to minimize life cycle cost, energy consumption, and maintenance through the proper selection of mass, forms, materials and construction standards. Use integrally-colored materials to eliminate painting.
- 2.6.1.6 Locate all above grade utility connections, vents and other projections through exterior walls away from high-visibility areas, such as front facades or pedestrian areas.

#### 2.6.2 Handicapped Requirements

Compliance with ADA criteria not required due to mission requirements of the facility .

#### 2.6.3 Gross Floor Area

The programmed gross floor area of this project is 6,900 square meters (74,273 SF). The Contractor is not required to approach this area. A greater or lesser area is acceptable if it meets all of RFP requirements.

#### 2.6.4 Net Floor Areas

Net floor area is that space within the interior faces of exterior walls and/or interior walls. The following minimum areas as shown in (square meters) shall be maintained. Other areas are shown for guidance in preparing the project. Actual amount on space required for each area will be determined by the Design-Build Contractor to accommodate equipment and furniture requirements and space clearances for equipment service.

	Room Name	Net Area (SM)	Remarks
(1)	De-Painting (Strip) Hangar Bay		
	First Line Supv Office	(9.3)	
	Second Line Supv Office	(9.3)	
	Clerical Room	(9)	
	Supply Storage		
	Observation Booth		
	Change Room		
	DMB Equipment Rooms -2 identical		
	equipment room to house		

two identical DMB equipments.

- (2) Paint Hangar Bay
  - First Line Supv Office (9.3)
  - Second Line Supv Office (9.3)
  - Clerical Room (9)
  - ~~Observation Booth~~
  - Paint Mixing Room
  - Paint Storage Room
  - Paint Pot Cleaning Room
  - Template Shop

- (3) Wash Hangar Bay
  - First Line Supv Office (9.3)
  - Second Line Supv Office (9.3)
  - Clerical Room (9)
  - ~~Observation Booth~~

#### Special Support Areas

- Men's Locker Room
- Women's Locker Room
- Men's Restroom
- Women's Restroom
- Break rooms
- Technical Order Library

#### Production Support Areas

- Centralized Chemical Storage and Pump Room
- Air Compressor/Dryer Room
- Wash Water Recycle and High Pressure Wash Equipment Room
- Material Issue Center (MIC)

#### Building Support Areas

- Mechanical Room
- Communication Room
- Electrical Room

#### 2.6.4.1 Functional Requirements

- a. De-painting (stripping) Hangar Bay: See paragraph 2.9.1 and 2.9.2 for requirements.
- b. Painting Hangar Bay: See paragraph 2.9.3 for requirements.
- c. Wash Hangar Bay: See paragraph 2.9.4 for requirements.
- d. Material Issue Center (MIC) and Paint Mixing Room: See paragraph 2.9.5.

#### 2.6.4.2 Clearances Requirements

##### 2.6.4.2.1 Paint Bay Tail Surface Access Requirements

The paint bay aircraft tail to ceiling clearance shall be designed such that operators standing on the telecrane work platforms (**see option for telecranes**) can maintain a paint-gun stand off distance of 254-610 mm



(10-24 inches) range from all upper surfaces of the C-130. A short man's [1.5 m (5'-0" high)] and tall man's [2.2 m (7'-6" high)] reach must be factored into this. For the vertical tail surfaces, operators standing on the telecrane work platforms shall be capable of maintaining the required 610 mm (24") stand-off distance, including the very top surfaces of the tail while reaching out at a zero to forty-five (0-45) degree angle range downward from the telecrane work platforms. Note: The C-130 tail height shall be considered with all aircraft wheels on the hanger bay floor, and all landing gear shock struts at full, maximum extension.

~~Design of this part of the hangar shall include provisions to extend the structure vertically to accommodate tails up to 13.7 meters (45 feet) high [C-130 is 11.8 meters (39 feet)]. Extensions of the tail tele-crane system shall also be considered in design. That is, a system that can be extended is preferred, if it can be done at low or no cost. With this, all medium cargo aircraft that the Air Force might procure to replace its aging fleet, can be incorporated to a plan in the future and at minimum cost.~~

#### 2.6.4.2.2 Wash And Depaint Bay Tail Surface Access Requirements

The wash and repaint bay aircraft tail to ceiling clearance shall be designed with all required clearance for JLG boom and work platforms such that operators standing on a JLG with extended booms and work platforms can maintain a stripping or wash nozzle stand off distance range of 457 mm to 610 mm (18 to 24 inches) from all upper surfaces of the C-130. Consider the requirements of short and tall people, as above. For the vertical tail surfaces, operators standing on the JLG work platforms on extended booms shall be capable of maintaining the required 457-610 mm (18"-24") stand-off distance range from all surfaces of the tail and rudder, including the very top surface while reaching out horizontally from the JLG work platforms. Note: The C-130 tail height shall be considered with the aircraft wheels located on 305 mm (12") tall above ground level (AGL) roll-up work platforms, and all landing gear shock struts at full, maximum extension. Work platform must be capable of allowing an operator to spray at angles of zero to forty-five (0-45) degrees downward onto the top of the tail, wing and fuselage.

#### 2.6.4.2.3 Minimum Safe Stand-Off Distance

There must be a minimum safe stand-off distance established, to allow for the safe raising and lowering of work platforms (such as telecrane and JLG platforms). Once the platform is at the desired working level, the operator can position the platform the desired 914-1219 mm (36"-48") from the aircraft. Such distances might possibly follow manufacturer's recommendations. They surely would be directly proportional to operating speed.

A minimum distance of 2.4 meters (8 feet) to the building and another 2.4 meters (8 feet) to the aircraft surface from the nearest work platform rail, with an overhead minimum clearance of 1.2 meters (4 feet) from lights and structure above a 2.3 m (7'-6") operator's head are required. These clearances would be used if stricter (greater stand-off distance) standards are not applicable—such as AFOSH or OSHA. Such hangar-to-aircraft distances as found in AFH 32-1084 would apply.

These are quoted in the next paragraph.

The clearance between any part of the aircraft and the hangar structure, appurtenances such as pipes, and lighting must be a minimum of 3 meters (ten feet). Table 7.2 on p. 103 of AFH 32-1084 specifies 3 meters (ten feet) minimum clearance to walls and to roof from the horizontal tail, 2.1 meter (7 feet) from vertical tail to door, 4.6 meters (15 feet) from wing-tip to walls, and 3 meters (10 feet) between aircraft in the hangar. Paragraph 7.11.2 on p. 109 indicates 3 meters (10 foot) clearance is added for work stands around fighter aircraft. A minimum of 48.7 meter (160 feet) or greater hangar door opening is required.

#### 2.6.5 Special Requirements for Various Rooms or Spaces

2.6.5.1 Dry Media Blast Bay: Interior walls and ceilings surfaces including structural members shall be able to be washed down with water. Personnel doors shall be located in relation with the blasting hoses such that an open door cannot be blasted by th media hoses. Provide seals around all doors.

2.6.5.2 Paint Storage Room and Paint Mixing Room (Paint Bay): The rooms shall have a combined 93 square meter area (lesser or greater) and be adjacent to each other and ventilated. The rooms shall conform to NFPA 33 requirements. A 3048 mm long work table shall be provided in the mixing room.

2.6.5.3 All hangar bay concrete floors shall have hardeners (**see paragraph 2.7.7.5**). ~~and chemical resistant floor coating.~~

2.6.5.4 Restrooms: Male and female restrooms shall be provided. Number of fixtures shall be 75% to 25% male:female ratio for the project. Designer has the option to provide restrooms in each hangar bay. Provide a full range of first quality commercial toilet room accessories as appropriate to suit the required functions. See par. 2.7.

2.6.5.5 Janitor Room: Shall have an adjustable, stacked, wall mounted shelving and a wall mounted mop sink with mop rack.

2.6.5.6 Communication Room: Plywood boards, 19 mm thick, shall be provided for anchoring of all equipment. Boards shall be sized to fit all required equipment.

2.6.5.7 Tug Doors: A pull-through tug doors for the de-painting, wash, and paint hangar bays shall be provided. Each door shall be 3658 mm wide x 3658 mm high, overhead coiling type, heavy duty steel construction, insulated and shall be provided with electric motor unit with manual override operation. Coiling door shall be controlled from both inside and outside.

2.6.5.8 Break rooms: Break rooms shall be provided in each hangar bay. The break room shall have sink and cabinets and provisions for vending machines, microwave, coffee pots, refrigerator, and ice machine.

2.6.5.9 Locker Room and shower: Provide locker room with shower in each hangar bay. One locker for personal item and one locker for equipment

shall be required for each personnel. Number of personnel ~~per bays are the following:~~ **for the facility will be 20 per shift (15 males, 5 females ) and 5 in the administration.**

a) ~~De painting Hangar Bay 14 people, 3 shift per day.~~

b) ~~Painting Hangar Bay 20 people, 3 shifts per day.~~

c) ~~Wash Hangar Bay 20 people, 3 shifts per day.~~

**2.6.5.10** The contractor shall orientate supporting spaces along with vestibules to minimize the affect from process conditions and promote effective maintenance of equipment.

## 2.6.6 Fire Safety

2.6.6.1 The Facility shall be constructed in accordance with Military Handbook 1008C, which references: a) applicable portions of the Uniform Building Code for the following: type of construction, fire resistance requirements, allowable floor area, building height limitations, and building separation distance requirements; and b) building construction related to egress and safety to life shall comply with NFPA 101. Type of occupancy shall be in accordance with UBC and NFPA. Fire Resistant plywood is not permitted as a roof sheathing material. Finishes shall be Class A or B except that smoke spread rating cannot exceed 100 for Class B.

2.6.6.2 All hazardous areas within the building shall be enclosed as required by NFPA 101 Life Safety dated 2000, and the Uniform Building Code as well as other portions of these codes as dictated.

## 2.6.7 Miscellaneous Metal

### 2.6.7.1 Fire Extinguisher Cabinets

2.6.7.1.1 All fire extinguisher cabinets shall be semi-recessed when located in partition walls and bracket mounted in other areas. Cabinet shall be factory finished color to match adjacent wall with a clear, breakable glass door. Cabinet box shall be 1.3 mm (18 gage) steel with baked enamel finish. Steel door and trim shall be one-piece construction with a continuous hinge and door shall have friction latches. Trim shall be rolled edge and finished in white baked enamel. Door shall be 16 mm (5/8 inch) thick, one-piece hollow steel, full glazed steel frame with rubber roller catch and satin finish door handle, and white baked enamel finish. Cabinets shall be sized to accommodate 20# ABC dry chemical capacity extinguishers. Cabinets shall be located in accordance with the provisions of NFPA 10.

2.6.7.1.2 All aircraft on which cleaning, paint removal, or painting operations are performed shall have, located within 15.2 m (50 feet) of the operations and available for immediate use, a minimum of one hand-portable fire extinguisher having at least a 20-B:C rating with a minimum capacity of 6.8 kg (15 lbs) of agent and one nonsparking wheeled fire extinguisher having at least 80-B:C rating with a minimum capacity of 58 kg (125 lb) of agent per NFPA 410 section 5-4.

### 2.6.7.2 Seismic Joint Covers

Where required, seismic joint covers shall be constructed of extruded

aluminum with anodized satin finish for walls and ceilings and with standard mill finish for floor covers and exterior covers.

### 2.6.7.3 Ladder

2.6.7.3.1 Ladder shall be provided for roof access. Ladder shall be detailed and submitted for comments prior to fabrication. Full dimensions, wall and floor attachments, materials, construction and finish must be shown and comply with all safety orders pertinent to the installation. Ladder shall comply to OSHA/ANSI A14.3.

2.6.7.3.2 Installation shall be according to manufacturer=s recommendations.

### 2.6.8 Insulation

Insulation values shall conform to Engineering Technical Letter (ETL) 94-4.

2.6.8.1 Provide the maximum thermal insulation values as follows:

	Metric AU@ Value		Metric RSI Value	English AU@ Value
Gross Wall	1.205	0.83 M50K/W	0.210	
Roof	0.190	5.26 M50K/W	0.052	

Gross Wall U-factor is the U-factor sum of each wall component (opaque wall, windows, doors, openings, etc.) times the area of that wall component, the sum divided by the total wall area. For bidding purposes R-30 for ceilings/roofs and R-19 for opaque wall shall be used as minimum values. However, R-value may vary (higher or lower) dependant upon the Design Energy Usage (DEU).

2.6.8.2 Thermal and sound insulation shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less exclusive of the barrier when tested in accordance with ASTM E-84. A vapor barrier shall be provided on the warm side of exterior and ceiling insulation where occurs. Insulation shall have a facing providing a permeability of 0.1 perm or less when tested in accordance with ASTM E 96.

2.6.8.3 Insulation: Thermal resistance of insulation shall not be less than the R-values determined from the "U" values indicated in paragraph 2.6.8.1. R-values shall be determined at 24 degrees C (75 degrees F) in accordance with ASTM C 518. Insulation shall contain the highest practicable percentage of recovered material which has been recovered or diverted from solid waste, but not including material reused in a manufacturing process. Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Materials containing more than one percent asbestos will not be allowed.

2.6.8.4 Insulation that is part of standing seam roofing system: see  
2.6.10.7 for other requirements.

#### 2.6.8.5 Batt/Blanket Insulation:

2.6.8.5.1 Glass Fiber Batts and Rolls: Glass fiber batts and rolls shall conform to ASTM C 665, (Type I unfaced insulation at walls air conditioned on both sides) (Type III foil faced insulation, Class A, at walls air conditioned on only one side), having a UL rating of 25 and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84.

2.6.8.5.2 Mineral Fiber Batt: Mineral fiber batt shall conform to ASTM C 665, (Type I unfaced insulation at walls air conditioned on both sides) (Type III foil faced insulation, Class A, at walls air conditioned on only one side).

2.6.8.5.3 Mineral fiber blanket shall conform to ASTM C 553, Type I, Class 6. Blankets shall be sized to suit construction conditions, resilient type for use below and above ambient temperature to 195 degrees C. (350 degrees F). Blankets shall have a factory applied vapor-barrier facing on one side with 50 mm (2 inch) nailing tabs on both edges. Vapor barriers shall be fire retardant, high vapor transmission, and aluminum foil laminated to crepe paper type conforming to ASTM C 1136, Type II. Nominal density shall be 12 kg per cubic meter (0.75 pcf).

2.6.8.5.4 Wall and ceiling acoustical insulation shall be mineral fiber complying with ASTM C 665 and ASTM E 136, STC rating improvement of 4 to 10 dbs over thermal units 150 mm (6") thick.

#### 2.6.9 Casework

All Casework shall meet the requirements of the Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program as set forth by the Architectural Woodwork Institute for architectural cabinets with high pressure decorative laminate (HPDL). Quality shall be custom grade.

The Contractor shall provide a schedule of casework.

#### 2.6.10 Structural Standing Seam Metal Roofing (SSSMR) and Wall Panel

Slope: Roof slopes shall be pitched and shall meet manufacturer's minimum slope for warranty requirements. Height of standing seam shall be not less than 89 mm (3-1/2 inches). Roof design requirements shall conform to the Base Facility Standard Requirements. (See Attachment)

##### 2.6.10.1 (a) Roof Panels

Panels shall be steel or aluminum standing seam with concealed fasteners and shall have a factory color finish. Roof deck assemblies shall be Class 90 as defined in UL 580. Length of sheet shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 9144 mm (30 feet). When length of run exceeds 9144 mm (30 feet) and panel laps are provided, each sheet in the run shall extend over three or more supports. Sheets longer than 30 meter (100 feet) may be furnished if approved by the Contracting Officer. Width of sheets shall provide not more than 610 mm of coverage in place. SSSMR system with roofing panels greater than 305 mm (12

inches) in width shall have standing seams rolled during installation by an electrically driven seaming machine. Height of standing seams shall be not less than 89 mm (3-1/2 inches).

#### 2.6.10.1 (b) Wall Panels

Panels shall be steel and shall have a factory color finish. Length of sheet shall be sufficient to cover the entire height of any unbroken wall surface when length of run is 9144 mm (30 feet) or less. When length of run exceeds 9144 mm (30 feet), each sheet in the run shall extend over two or more spans. Sheets longer than 9144 mm (30 feet) may be furnished if approved by the Contracting Officer. Width of sheets with interlocking ribs shall provide not less than 305 mm (12 inches) of coverage in place. Wall panels shall be fastened to framework using exposed or concealed fasteners.

##### 2.6.10.1.1. Steel Panels

Zinc-coated steel conforming to ASTM A 653/A653M; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 55 coating; or aluminum-coated steel conforming to ASTM A 463/A 463M, Type 2, coating designation T2 65. Panels shall be 0.610 mm (0.024-inch) thick minimum.

##### 2.6.10.1.2 Aluminum Panels

Alloy conforming to ASTM B 209, temper as required for the forming operation, minimum 0.8mm (0.032-inch) thick.

2.6.10.1.2 Performance Standards: The SSMRS shall be tested for wind uplift in accordance with ASTM E 1592; SSSMR systems previously tested and approved by the Corps of Engineers= STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE may be acceptable. Two tests shall be performed. Test 1 shall simulate the edge condition with one end having crosswise restraint and other end free of crosswise restraint. The maximum span length for the edge condition shall be 762 mm (30 inches). Test 2 shall simulate the interior condition with both ends free of crosswise restraint. The maximum span length for the interior condition shall be 1524 mm (5 feet). External reinforcement, such as clamps on the ribs, is not acceptable to improve uplift resistance. Bolts through seams shall not be installed.

**2.6.10.2 Concealed Anchor Clips:** Concealed anchor clips shall be as recommended by the manufacturer for the roofing system furnished. Clip bases shall have factory punched or drilled holes for attachment. Clips used with panel width greater than 305 mm (12 inches) shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip.

2.6.10.3 Accessories: Accessories shall be furnished with the Standing Seam Metal Roof and Wall System. Flashing, trim, soffits, fascias, metal closure strips, caps, and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water. The use of a

continuous angle butted to the panel ends to form a closure will not be allowed. Thermal spacer blocks and other thermal barriers at roof panels concealed clip fasteners shall be as recommended by the manufacturer.

2.6.10.4 Fasteners: Fasteners for steel roof and wall panels shall be zinc-coated steel, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum roof panels shall be aluminum or corrosion resisting steel. Fasteners for roof panels structural connections and attaching wall panels to supports shall provide both tensile and shear strength of not less than 3340 N (750 pounds) per fastener. Fasteners for accessories shall be the manufacturer's standard.

a) Exposed wall fasteners shall be color finished or provided with plastic color caps to match the panels. Nonpenetrating fastener system using concealed clips shall be manufacturer's standard for the system provided.

2.6.10.4.1 Screws: Screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.

2.6.10.4.2 Bolts: Bolts shall be not less than 1/4-inch diameter, shouldered or plain shank as required, with locking washers and nuts.

2.6.10.4.3 Structural Blind Fasteners (Roof Panels): Blind screw-type expandable fasteners shall be not less than 6 mm (1/4-inch) diameter. Blind (pop) rivets shall be 7 mm (9/32-inch) minimum diameter.

2.6.10.4.4 End-Welded Studs (for wall panels): Automatic end-welded studs shall be shouldered type with a shank diameter of not less than 5 mm (3/16 inch) and cap or nut for holding panels against the shoulder.

2.6.10.4.5 Explosive Actuated Fasteners (for wall panels). Fasteners for use with explosive actuated tools shall have a shank of not less than 0.37 mm (0.0145 inch) with a shank length of not less than 13 mm (1/2 inch) for fastening panels to concrete. A permit issued by Base Civil Engineer (BCE) must be issued prior to use on base.

2.6.10.4.6 Blind Rivets (for wall panels). Blind rivets shall be aluminum with 3/16 inch nominal diameter shank or stainless steel with 3 mm (1/8 inch) nominal diameter shank. Rivets shall be threaded stem type if used for other than the fastening of trim. Rivets with hollow stems shall have closed ends.

2.6.10.5 Subpurlins: Subpurlins, when required by the roofing system design, shall be formed from steel sheet as standard with the manufacturer. The uncoated thickness may be a minimum of 1.5 mm (0.059-inches) if bolts or structural blind fasteners are used for attachment of the concealed anchor clips to the subpurlins.

2.6.10.6 Factory Color Finish

Roof and wall panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall be

approved by the contracting officer. The exterior coating shall be a nominal 0.025 mm (1 mil) thickness consisting of a topcoat of not less than 0.018 mm (0.7 mil) dry film thickness and the paint manufacturer's recommended primer of not less than 0.005 mm (0.2 mil) thickness. The interior color finish shall consist of a 0.005 mm (0.2 thick) prime coat. The exterior color finish shall meet the test requirements specified below.

- 2.6.10.6.1 Salt Spray Test:** A Sample of the sheets shall withstand a salt spray test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirements in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; And rating of 6, 2 mm to 3 mm (1/16 to 1/8-inch) failure at scribe, as determined by ASTM D 1654.
- 2.6.10.6.2 Formability Test:** When subjected to testing in accordance with ASTM D 522 Method B, 3 mm (1/8 inch) diameter mandrel, The coating film shall no evidence of fracturing to the naked eye.
- 2.6.10.6.3 Accelerated Weathering, Chalking Resistance and Color Change:** A sample of the sheets shall be tested in accordance with ASTM D 4587, test condition B for 1000 total hours. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244.
- 2.6.10.6.4 Humidity Test:** When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.
- 2.6.10.6.5 Impact Resistance:** Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 equal to 1.5 times metal thickness in mm (mils), expressed in newton-meter (inch-pounds), with no loss of adhesion.
- 2.6.10.6.6 Abrasion Resistance Test:** When subjected to the falling sand test in accordance with ASTM D 968 the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.
- 2.6.10.6.7 Specular Gloss (Roof Panel):** Finished surfaces shall have a specular gloss of 10 or less at an angle of 85 degrees when measured in accordance with ASTM D 523.
- 2.6.10.6.8 Pollution Resistance:** Coating shall show no visual effects when immersion tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.
- 2.6.10.7 Insulation:** R-values shall be determined at a mean temperature of



24 degrees C (75 degrees F) in accordance with ASTM C 518. Insulation shall be a standard product of a manufacturer, factory-marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Insulation, including facing, shall have a flame spread not in excess of 25 and a smoked developed raring not in excess of 50 when tested in accordance with ASTM E 84. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's Laboratory.

#### 2.6.10.7.1 Rigid or Semirigid Board Insulation

Polyisocyanurate insulation shall conform to ASTM C 1289, Type II, Class 1 (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). For polyisocyanurate the maximum design R-value per 25 mm (1 inch) of insulation used shall be 1.27. Facings shall be non-asphaltic, glass fiber reinforced.

#### 2.6.10.7.2 Blanket Insulation

Blanket Insulation shall conform to ASTM C 991.

#### 2.6.10.8 Vapor Retarders as Integral Facing: Insulation facing shall have a permeability of 0.1 perm or less when tested in accordance with ASTM E 96. Facing shall be white of reinforced foil with vinyl finish; except that unreinforced foil with a natural finish may be used in concealed locations. Facings and finishes shall be factory applied.

#### 2.6.10.9 Insulation Retainer System: Insulation retainer system shall be type, size, and design necessary to adequately hold the insulation and to provide a neat appearance. Metallic retaining members shall be nonferrous or have a nonferrous coating. Nonmetallic retaining members, including adhesives used in conjunction with mechanical retainers or at insulation seams, shall have a fire resistance classification not less than that permitted for the insulation. Insulation retainer shall not be adhered to underside of metal roof panels.

#### 2.6.10.10 Wall Liners

Wall liners shall be 0.61 mm (0.024-inch) thick minimum for aluminum or 0.46 mm (0.018-inch) thick minimum for steel with the same composition specified for siding and formed or patterned to prevent waviness and distortion. Matching metal trim shall be provided at base of wall liner, top of wall liner, around openings in walls and over interior and exterior corners. Wall liners shall have the same factory color finish as specified for the wall panels.

#### 2.6.10.11 Sealant: Except as stated below, sealants shall be elastomeric type containing no oil or asphalt. Exposed sealant shall cure to a rubberlike consistency. All sealants shall be the non-hardening type. Roof panel standing seam ribs shall have a continuous sealant that is factory installed.

#### 2.6.10.12 Gaskets and Insulating Compounds: Gaskets and insulating compounds shall be non-absorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be non-

running after drying.

- 2.6.10.13 EPDM Rubber Boots: Flashing devices around roof pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber. Rubber boot material shall be as recommended by the manufacturer. The boots shall have base rings made of aluminum or corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.

2.6.10.14 Warranties

a. The SSMRS shall be guaranteed for 20 years against leakage arising out of or caused by ordinary wear and tear by the elements. Such guarantee shall be non-prorated and start upon final acceptance of the work or the date the Government takes possession, whichever is earlier.

b. The Contractor shall provide a weather tight warranty for the metal siding for a period of 20 years to include siding panel assembly, 10 years against the wear of color finish, and 10 years against the corrosion of fasteners caused by ordinary wear and tear by the elements. Such guarantee shall be non-prorated and start upon final acceptance of the work or the date the Government takes possession, whichever is earlier.

2.6.10.15 Snowguards

Snowguard shall match roof panel or polycarbonate. Snowguard density and spacing requirements shall be as recommended by the manufacturer and visual appeal shall be considered when determining the layout. Penetration of roof panel is prohibited. Metal snowguards color shall match roof. Polycarbonate snowguard color shall be clear or integrally colored to match roof. Snowguard shall be installed in compliance with manufacturer's instruction for installation.

2.6.11 Sheet Metalwork

Flashings shall be installed in conformance with the SMACNA Architectural Sheet Metal Manual.

2.6.12 Firestopping

- 2.6.12.1 Material shall have a flame spread of 25 or less, a smoke developed rating of 50 or less, and a fuel contribution of 50 or less when tested in accordance with ASTM E 84 or UL 723.

- 2.6.12.2 The materials shall be nontoxic to human beings at all stages of applications and during fire conditions.

- 2.6.12.3 Firestopping materials for through-penetrations of fire resistance rated construction shall provide fire resistance rating in accordance to ASTM E 814 or UL 1479.

- 2.6.12.4 Firestopping materials for construction joints in fire resistance rated construction shall provide a fire resistance rating in accordance to ASTM E 119 or UL 263. Construction joints include those joints used to accommodate expansion, contraction, wind or seismic movement of the

building.

2.6.12.5 Material shall be non-combustible when tested in accordance with ASTM E 136.

#### 2.6.13 Caulking and Sealants

2.6.13.1 Caulking and sealants shall be selected according to materials they are being applied to for compatibility. These sealants and caulks shall be either a two-component, rubber base, chemical-curing compound based on polysulfide and/or polyurethane; or a single-component, rubber base, chemical-curing compound such as polysulfides, polyurethanes, and silicones.

2.6.13.2 Caulking shall occur around all door frames, all window frames, and at all material changes. The minimum joint width shall be 6 mm (1/4 inch), and joint widths in excess of 6 mm (1/4 inch) shall have a back stop material provided in the joint, and the depth of all joints shall be equal to the width. Color of caulking and sealants shall match adjacent materials.

#### 2.6.14 Steel Doors and Frames

2.6.14.1 Exterior doors shall be heavy duty 45 mm (1 3/4") thick steel Type II, and steel frames, both doors and frames shall be hot dipped galvanized (G-90 minimum) per ASTM A-653.

2.6.14.2 Exterior doors shall be insulated and weather-stripped.

#### 2.6.15 Exterior Windows

2.6.15.1 Aluminum exterior windows shall be glazed with insulated glass with minimum 9 mm (3/8 inch) air space and shall conform to ASTM E 773 and ASTM E 774. Glazing shall have a maximum condensation factor of 48% in accordance with AAMA 1502.7.

2.6.15.2 Windows shall be operable, projected in "hopper type" with concealed 4 bar friction hinges with bronze tinted glass and bronze anodized finished frames. Bug screens shall be manufacturer's standard aluminum framed units provided for all operable sash.

2.6.15.3 All windows shall be heavy commercial class 40 (HC-40) grade.

2.6.15.4 All window frames and sash shall have 25 mm (1 inch) thick glazing units consisting of two panes of glass, with air space hermetically sealed.

2.6.15.5 All window frames and sash shall be constructed with a thermal break feature.

2.6.15.6 All window frames and sash shall be designed to withstand a 145 kph (90 mile per hour) wind velocity.

**2.6.15.7** Window sills shall be nonporous, hard surface, easily maintained product.

#### 2.6.16 Wood Doors

2.6.16.1 Interior doors shall be 45 mm (1 3/4") solid core flush wood doors, with cores bonded to the door stiles and rails, stained to match wood finish throughout facility, and have a clear protective finish applied over the stain, premium grade in accordance with NWWDA I.S.1-A, good grade, birch. All wood doors shall be 5-ply or 7-ply construction with faces, stiles and rails bonded to the cores. Wood doors shall have painted steel frames (see par. 2.6.14).

2.6.16.2 Door lites if applicable on interior doors shall be minimum 150 mm (6 inches) wide by 760 mm (2'-6" inches) high positioned at a height above finished floor to allow vision.

#### 2.6.17 Hardware

**a.** All hardware in this building shall be consistent. All requirements for hardware keying shall be coordinated with the Contracting Officer. The following hardware requirements are to be included.

**b.** Hardware for fire rated doors shall conform to the requirements of NFPA 80 and NFPA 101.

##### 2.6.17.1 Hinges

2.6.17.1.1 Exterior hinges shall have nonremovable pins and be stainless steel; Grade 1 (except at doors to Mech/Elec rooms, which may be Grade 3); antifriction or ball bearing; and 3 each of 114 mm x 114 mm (4-1/2" x 4-1/2") per leaf up to 900 mm (3') wide door (127 mm x 127 mm (5" x 5") for doors 900 mm (3') to 1,200 mm (4') wide).

2.6.17.1.2 Interior hinges shall be Grade 1; antifriction or ball bearing; and 3 each of 114 mm x 114 mm (4-1/2" x 4-1/2") per leaf up to 900 mm (3') wide door (127 mm x 127 mm (5" x 5") for doors 900 mm (3') to 1,200 mm (4') wide). Hinges for labeled fire doors must be either steel or stainless steel.

2.6.17.1.3 Hinges shall conform to ANSI/BHMA A156.1 and A156.7.

##### 2.6.17.2 Locksets, Latchsets, Exit Devices, and Push and Pull Plates

2.6.17.2.1 Exterior doors shall have mortise locks conforming to ANSI/BHMA A156.13 for metal doors, Grade 1.

2.6.17.2.2 Interior doors shall have mortise locksets conforming to ANSI/BHMA A156.13, Series 1000, Grade 1.

2.6.17.2.3 All doors to exterior, with the exception of the mechanical and electrical room doors, shall have full-width flush-mounted panic bars per ANSI/BHMA 156.3, narrow style concealed, and automatic door hold-open devices in the closer per ANSI/BHMA A156.4.

2.6.17.2.4 All locks and latchsets shall be the product of the ASSA system.

2.6.17.2.5 Unless otherwise indicated, all locksets and latchsets shall be provided with lever handles on each side.

### 2.6.17.3 Cylinders

Lock cylinders shall comply with BHMA A156.5 and be ASSA Lock Company. Lock cylinder shall have not less than six pins. Cylinders shall have key removable type cores. All cores shall be ASSA Lock Company. Cylinders shall have key interchangeable type cores. Construction cores shall be provided. All locksets, exit devices, and padlocks shall accept same interchangeable cores.

### 2.6.17.4 Closers

2.6.17.4.1 Closers shall be provided on all exterior doors, fire-rated doors, and restroom doors.

2.6.17.4.2 Closers shall conform to ANSI/BHMA A156.4, Grade 1. Closers shall be surface-mounted, modern type, with cover. Closers shall be provided with options PT-4F and PT-4H (delayed action).

### 2.6.17.5 Keying

The entire project shall be an extension of existing keying system as specified by the Hill AFB Civil Engineer. All doors shall be keyed as specified by the Hill AFB Civil Engineer. All submittals/shop drawings referring to keys and keying shall be submitted to the Hill AFB Civil Engineer for coordination and approval. Furnish two sets of blank keys for each lock. All keying shall be done by Hill AFB Civil Engineer. All locks shall be furnished with removable core cylinders. Replacement cores shall be ASSA removable cores. Keys and permanent cores shall be shipped directly to Air Force Project Manager. Provide one master key for mechanical, electrical, and communications rooms to Contracting Officer. Master keying shall be ASSA V-80600 series with six-pin tumbler removable cores. See attachment on Justification and Approval for other than full and open competition.

### 2.6.17.6 Thresholds

All exterior doors (except Mech/Elec rooms) shall be provided with aluminum threshold conforming to ANSI/BHMA A156.21.

### 2.6.17.7 Kick Plates and Mop Plates

2.6.17.7.1 Metal Kick plates or mop plates shall be provided on all wood doors. Match metal finish with door hardware finish.

2.6.17.7.2 Kick plates and mop plates shall comply with ANSI/BHMA A156.6, shall be 400 mm (16 inches) high by 50 mm (2 inches) less than width of door. Edges shall be beveled.

### 2.6.17.8 Door Stops

2.6.17.8.1 Door stops shall be provided on all doors that swing against a wall.

2.6.17.8.2 Door stops shall comply with ANSI/BHMA A156.16, Grade 1.

### 2.6.17.9 Glazing

2.6.17.9.1 Glass shall conform to the requirements of ASTM C 1036.

2.6.17.9.2 Glass in doors and adjacent to doors shall conform to the requirements of CFR 16 Part 1201.

2.6.17.9.3 Glazing of interior vision panels shall conform to CFR 16 Part 1201.

#### 2.6.18 Hangar Doors

*Fabric or combinations of various hangar bay door types may be used. Hangar bay doors shall meet all airfield fire and safety requirements. Hangar bay doors shall be motorized, insulated (approx. R-3), and of noncombustible construction. Hangar bay doors shall meet all wind loading requirements and be equipped with weather seals all around perimeter, sills and jambs. The design shall prevent birds from nesting in the exterior structure. The doors shall have very low air infiltration (rate per door leaf of maximum in cubic feet per minute of  $0.97 \times$  total door height in feet). When adjacent hangar bay doors are open and/or closed, they may not impact the sealing or process containment of the closed doors in the adjacent bays. Provisions for hook-up of external power to open/close doors shall be provided should the building electrical power be lost. All hangar bay doors need not be able to be open at the same time. Aircraft stand-off distances from the facility walls and door openings shall be per AFH 32-1084. Doors shall complying with NFPA 409, 2-7.*

~~Hangar doors for the facility shall be motorized sliding doors, insulated and of non-combustible construction. Hangar door shall meet all wind loading requirements and equipped with weather seals all around perimeter, sills and jambs. Design to prevent birds from nesting in exterior structure.~~

##### 2.6.18.1 Fabric Hangar Doors

*Fabric doors shall have minimum 250 pounds/inch tensile strength, be resistant to light, and be resistant to UV rays. Fabric shall be Class A with flame-spread of 0-25 and shall be self-extinguishing. Placement of heating equipment shall be coordinated with doors so not to cause damage to the doors.*

#### 2.6.19 Overhead Coiling Doors

Overhead coiling doors shall be spring counterbalanced, coiling type, insulated interlocking slats with a minimum R-value of 4, complete with guides, fastenings, hood, brackets, and operating mechanism. Doors shall be surface-mounted type with guides at jambs set back a sufficient distance to clear the opening. Exterior doors shall be mounted on interior side of walls. Coiling doors shall be provided with electric motor unit with manual override operation.

#### 2.6.20 Gypsum Wallboard

2.6.20.1 Gypsum wallboard shall conform to the requirements of ASTM C 36 and be 1200 mm (48") wide, 16 mm (5/8") thick, and tapered edged. Steel framing, furring, and related items shall conform to the requirements

of ASTM C 645 and C 955 where applicable.

2.6.20.2 Joint treatment materials shall conform to the requirements of ASTM C 475.

2.6.20.3 Screws shall conform to the requirements of ASTM C 1002 and C 954 where applicable.

2.6.20.4 Corner beads, edge trim, and control (expansion) joints shall conform to the requirements of ASTM C 1047, and shall be corrosion protective-coated steel designed for its intended use. Flanges shall be free of dirt, grease, and other materials that may adversely affect the bond of joint treatment.

#### 2.6.21 Painting

2.6.21.1 Interior exposed surfaces, except factory prefinished material or interior surfaces receiving acoustical wallcovering or vinyl wallcovering, shall be painted a minimum of one prime coat and two finish coat. The prime coat for concrete masonry units shall be TT-F-1098. All spaces shall have satin or eggshell or semi-gloss finish on walls, semi-gloss finish on trim and eggshell or semi-gloss finish on ceilings. Stain with two coats of varnish on finished interior doors is acceptable. Do not use flat finish.

2.6.21.2 All exterior surfaces to be painted, including all utility appendages shall receive a minimum of one prime coat and two finish coats of paint.

2.6.21.3 Water repellent sealer shall be clear, water repellent solution designed to protect vertical concrete masonry unit surfaces from water penetration. Sealer shall comply with VOC content requirements of the local Air Pollution Control District and shall comply with ASTM C 67, D 3278, and E 514.

2.6.21.4 Application of paint. Paint shall be applied by brush or roller. Spray painting method shall be used only under approved conditions. Spraying shall be done only when there is no wind, or under very low wind velocity. When wind velocity increases, all spraying operation shall be stopped as directed by the Contracting Officer. Before start of spraying, all surfaces that do not require painting shall be completely masked and protected. Adequate drop cloths shall be provided over floors, adjacent sidewalks, and over all cars parked nearby that may be stained or damaged from the spray work. The Contractor shall be liable for all damage resulting from the spray painting operation. All such damages shall be satisfactorily repaired and resolved at no additional cost to the Government. Adequate ventilation shall be provided during paint application. Respirators shall be worn by all persons engaged in spray painting. Adjacent areas shall be protected by approved precautionary measures.

2.6.21.5 Paints shall comply with State Regulations and the following Federal and Military Specifications. No lead paints are acceptable. Interior latex paints are not permitted in toilet rooms.

TT-C-535                      Epoxy, Interior For Wet Areas (Gypsum Wallboard)

TT-C-542	Polyurethane, Interior For High Degree of Sanitation (Masonry and Gypsum Wallboard)
TT-E-487E & Am-1	Enamel: Exterior, Floor and Deck.
TT-E-489J	Enamel, Alkyd, Gloss (For Exterior and Interior Surfaces).
TT-F-1098	Filler, Block, Solvent-Thinned, for Porous Surfaces, (Concrete Block, Cinder Block, Stucco, Etc.).
TT-P-19D	Paint, Latex (Acrylic Emulsion), Exterior, Wood and Masonry.
TT-P-29K	Paint, Latex Base, Interior, Flat, White and & Am-1 Tints.
TT-P-31D	Paint, Oil: Iron-Oxide, Ready-Mixed, Red and Brown.
TT-P-37C & Am-4	Paint, Alkyd Resin: Exterior Trim, Deep Colors.
TT-P-38E & Am-1	Paint, Aluminum, Ready-Mixed.
TT-P-102F  & Int. Am-1	Paint, Oil, Alkyd Modified, Exterior, White and Tints.
TT-P-645B	Primer, Paint, Zinc-Molybdate, Alkyd Type.
TT-P-650D & Am-1	Primer Coating, Latex Base, Interior, White (For Gypsum Wallboard).
TT-P-1511B	Paint, Latex (Glass & Semigloss, Tints & White) (For Interior Use)
TT-P-001984	Primer Coating, Latex Base, Exterior Wood
TT-S-708A & Am-2	Stain, Oil: Semi-Transparent, Wood, Exterior.
TT-S-711C	Stain, Latex, Wood, Interior
TT-S-001992	Stain, Latex, Exterior For Wood Surface.
TT-V-121H	Varnish, Spar, Water-Resisting.
SSPC Paint 5	Paint, For Interior Galvanized Surfaces.
SSPC Paint 21	Paint, Alkyd, For Factory Primed Mechanical and Electrical Equipment.

2.6.21.6 Colors shall be as approved from schemes submitted with proposal. Each proposal shall include one basic exterior and interior color coordinated schemes and color samples.



2.6.21.7 Pipes in exposed areas and in accessible pipe spaces shall be provided with color band and titles in accordance with Mil-Std 101.

#### 2.6.22 Acoustical Design

2.6.22.1 Though located within the 80-85 dB contour on the Base AICUZ map, the function of this facility does not require any special noise reduction from outside sources per Requirements Documents (RD).

2.6.22.2 All equipment shall be designed such that the noise levels shall not exceed 82 dba for an 8-hour time weighted average. At no time shall noise level exceed dba. If the noise level exceed this value, noise level shall be reduced through engineering control; i.e., insulation, dampening, isolation, etc.

**2.6.22.3** Careful attention to acoustical design shall be considered in the offices to ensure a high degree of isolation from any outside noise.

#### 2.6.23 Exterior Signs

Provide signs that comply with post architectural compatibility standard and comply with sign standards provided in Department of the Air Force, Sign Standard AFP 88-40 and be approved by the Contracting Officer.

#### 2.6.24 Structural Steel

##### 2.6.24.1 Bollards

Bollards shall be 100mm Dia., 6.3mm thick heavy duty steel pipe conforming to ASTM 120. Hollow core of the pipe shall be filled with concrete having a compressive strength of 21 MPa. Bollards color shall match Fed. Spec 595B Dakota Brown 30099 with two 4-inch reflector tape and be approved by the Contracting Officer. Bollards shall be placed with the centerline aligned with the edge of the door opening where required.

### 2.7 Color, Finishes and Materials

#### 2.7.1 Exterior Colors, Finishes and Materials

Exterior Finishes: Reference to Color, Finish Schedule for exterior colors shall be as contained below. Four sets of color boards for exterior materials shall be submitted at the time of the 60% design submittal. Materials and finishes shall meet criteria listed in Section 001010 General Project Description and General Design Requirements unless otherwise noted.

##### 2.7.1.1 Roof

The roof shall be structural standing seam metal roof. The roof shall have factory-applied finish, color shall be non-reflective off-white and be approved by the Contracting Officer. Design roof with good access with minimum requirements for snow removal.

#### 2.7.1.2 Fascia and Miscellaneous Exterior Features

The fascia and downspouts shall match the field metal siding color. Miscellaneous metals such as gutter, roof ladders, bollards, mechanical and electrical equipment, etc shall be painted or factory-finished to match Fed spec 595B #30099 Dakota Brown.

#### 2.7.1.3 Metal Siding

Metal siding shall be factory-applied finish with paint color to match Fed Spec 595B #23617 Greystone and be approved by the Contracting Officer.

#### 2.7.1.4 Concrete Masonry Unit (CMU)

This RFP allows either clay masonry unit (clay brick) or concrete masonry unit to be used in this project.

##### 2.7.1.4.1 Concrete Masonry Unit (CMU)

Concrete masonry unit shall be split-face integrally colored. Color shall match Fed Spec 595B #23617 Greystone and be approved by the Contracting Officer. Units shall be laid in half bond with mortar. Mortar color shall remain natural.

##### 2.7.1.4.2 Clay Masonry Unit (Clay Brick)

Clay masonry unit shall be smooth face of manufacturer's standard integrally colored. Color shall match Interstate Brick "Tumbleweed" and be approved by the Contracting Officer. Units shall be laid half bond with mortar. Mortar color shall remain natural.

2.7.1.4.3 Concrete masonry walls shall have control joints to accommodate movement to control cracking. Control joints shall be placed and spaced to divide walls into a series of rectangular panels. Control joints shall also be placed in areas of high stress concentration where cracking is most likely to occur. Normal spacing and desirable locations for control joints are as follows: at vertical spacing of joint reinforcement with 2-#9 wires at 400 mm (16 inches), the maximum horizontal spacing of control joints shall be not greater than 7,315 mm (24 feet) apart. Control joints shall not be located at openings. The spacing shall be reduced approximately 50% near masonry bonded corners or other similar conditions where one end of the masonry panel is restrained. Provide control joints at regular intervals, at changes in wall height or thickness, but not at pilasters, near wall intersections in "L", "T", and "U" shaped buildings at approximately 50% of the spacing required above and at other points of stress concentration.

#### 2.7.1.5 Doors and Windows

2.7.1.5.1 Exterior steel doors and door frames, shall be factory-applied finish to match Fed Spec 595B #30099 Dakota Brown and be approved by the Contracting Officer.

2.7.1.5.2 Exterior window , shall be factory-applied anodized bronze and be approved by the Contracting Officer.

## 2.7.2 Interior Finishes

2.7.2.1 Interior Finishes: Materials and finishes shall meet criteria listed in Section 001010 General Project Description and General Design Requirements unless otherwise noted.

2.7.2.2 Interior finishes and materials shall be specified with durability, maintenance, function, life cycle costs, code requirements and aesthetics being considered. Finishes and materials shall support the architectural elements and reflect the image and style of the using agency.

2.7.2.3 One species of wood and/or stain to represent one species of wood shall be specified throughout the entire facility. This encompasses casework, trim etc.

2.7.2.4 Upon the completion of construction, the Contractor shall provide and deliver at no additional cost, to the Contracting Officer, the following:

One percent extra of each color and texture of base of each total amount of each item used on the project.

## 2.7.3 Interior Colors

2.7.3.1 Finish and color selection shall be appropriate to the interior design intent to support the occupants, their activities and their customers. It is recommended that similar colors and patterns should be developed to create a common element between the exterior and interior.

2.7.3.2 A neutral color palette, earth tone, shall be incorporated for all permanent interior finishes to develop the neutral shell concept.

2.7.3.3 Non-permanent finishes include paint and other items that are relatively easy and inexpensive to replace.

2.7.3.4 All trim and resilient base shall be in the same color tone as overall facility and coordinate with the flooring and wall paint.

2.7.3.5 Colors and finishes shall be selected based on durability, maintenance, life cycle costs, code requirements, appearance and functional considerations. Variegated finishes and patterns are recommended to be implemented to the maximum extent possible as solids show wear and tear. Integral color and color through finishes shall be specified where applicable.

2.7.3.6 The colors and textures specified shall not date the facility and shall create an interior that will remain aesthetically pleasing over time. Finishes and materials shall support the architectural elements and reflect the image and style of the using agency.

**2.7.3.7** Brighter accent colors may be used only in small areas such as ceramic tile to add interest, create identity, and mask soil. Trendy patterns and colors shall be avoided.

## 2.7.4 Structural Interior Design (SID) Submittal Requirements

The Contractor shall prepare and provide to the Government, as a minimum four (4) submittals, one each to be distributed to the HQ AFMC, the Base Civil Engineering office, the user, and the Corps of Engineers, for review at each design phase of the project.

#### 2.7.4.1 Structural Interior Design (SID) Color Boards

The structural color boards shall depict all structural exterior and interior design materials and finishes. Label and coordinate samples according to the Exterior and Interior Color/Finish Schedules by referencing the alphanumeric legend. Display samples in a size large enough to indicate true patterns, color and texture. Securely mount samples to the color board modules to withstand long periods of use. Structural Interior Design (SID) is the specification and coordination of interior materials and finishes that includes structural surfaces, built-in features and features that are integral or attached to the building structure. This includes but is not limited to cabinetry, lockers, and window coverings.

#### 2.7.4.2 Presentation/Format Requirements

Presentation includes all information required to explain the structural related design. The binder format will be prepared with a standard 8 1/2" x 11" module basis to fit in a standard three (3) ring binder. The maximum spread dimensions shall be 25 1/2" x 33". Any full size drawing shall be folded to 8 1/2" x 11", and placed in a protective plastic sheet holder with the title block showing with no more than two (2) individual drawings per holder. Project title should occur on each module. The modules shall be rigid enough to support and anchor all samples. The front cover of the binder and spine of binder shall have a clear front that enables printed material to be inserted in the front cover and spine. Example: (K&M View Binder) The binder cover sheet shall be titled Structural Interior Design, and shall have the project name, location, submittal date, percentage and type (60% Preliminary, 100% Final, etc.) and the Corps of Engineers logo. Each module or sheet, with the exception of drawings, shall have project title and location depicted at the bottom of the sheet with the section (i.e. Color Board, etc.) at the top of the page. There shall be no fold outs on the top or bottom of the pages.

##### 2.7.4.2.1 Purpose

Illustrate the designer's design team's philosophy and intent to integrate all technical and visual design disciplines from concept through final design. Provide a visual record of the interior design solution for the facility to be used for material and finish selection approved during construction.

##### 2.7.4.2.2 Presentation of Color Boards

Provide One set of 16" x 20" boards, Containing all structural related (SID) finishes and materials, shall be presented to the user along with the Color/Finish Schedule to show or explain the design intent for the facility. The intent of this presentation is to allow the personnel using the facility to have input into the design and specification process.

#### 2.7.4.2.3 Samples

Samples shall be organized by material and finish color scheme with a separate sample for each scheme as appropriate. The schemes shall be coordinated by room names and numbers shown on the architectural floor plans, room finish and color schedule. All finishes shall be identified with written description including alphanumeric code (according to Color/Finish Schedule), application generic material name, manufacturer, color name and color number. Carpet samples must be large enough to indicate a complete pattern or design. No photographs or colored photographs of materials will be accepted or approved except to illustrate large pattern repeats.

#### 2.7.4.2.4 Submittals

Submittals shall be organized in a logical manner to facilitate an orderly and fast review. Narrative data should be clearly written. Drawings and photographs shall be clear and concise. Recommend that materials be organized in the following sequence:

##### Presentation (60%) Submittal Requirements

1. Design Objectives
2. Color/Finish Schedule
3. Presentation Color Boards

Final (90%) Design Submittal- Update and complete all information provided in previous submittal(s) listed above as well as providing:

##### Final (90%) Submittal Requirements

1. Title Page
2. Table of Contents
3. Design Objectives
4. Color/Finish Schedule
5. Electronic set of all Drawings/Plans/Schedules
6. Interior Color Boards

Corrected Final (100%) Submittal Requirements-Update and complete all information provided in previous submittal(s) listed above.

#### 2.7.4.2.5 Coordination

Ensure that the same numerical and verbal labeling appears on all floor plans, schedules, and color boards.

#### 2.7.4.2.6 Corrections to Submittals

The binders shall be submitted at each design phase to the Government for review. These review comments and the A-E's written responses should be provided in the front inside pocket of the first volume of the SID submittal binder. The designer should revise the binder after each review to respond to review comments. If the binders are not returned to the A-E after review the A-E may simply provide updated inserts to the Government in the same numbers as the binders not returned.

2.7.4.2.7. Interior finishes shall be selected to meet the Federal Procurement Policy guidelines to comply with Section 6002 of the Resource Conservation and Recovery Act (RCRA), @Federal Procurement@; and Executive Order (EO) 12873, AFederal Acquisition Recycling and Waste Prevention@, 1 May 1996 as well as ETL 00-1: EPA Guideline Items in Construction and Other Civil Engineering Specifications. Within parameter of performance, cost, aesthetics and availability, carefully select and specify building materials that limit impacts on the environment and occupant health. Building shall be free of asbestos containing material pursuant to OSHA asbestos regulations governing building owners, 29 CFR Part 1926. Limit the VOC content in architectural sealants (material with "adhesive" characteristics used as a filler; not materials used as a "coating"). Limit the VOC content in paints and coatings. Consider using the U.S. Green Building Council=s Leadership in Energy and Environmental Design (LEED) Building Rating System as an outline of environmental performance targets for the project. (U.S. Green Building Council=s Leadership in Energy and Environmental Design (LEED) Building Rating System can be accessed at: <http://www.usgbc.org/programs>). ). Elements to be considered during design and specification are:

- (a) Elimination of virgin material requirements
- (b) Use of recovered materials
- (c) Reuse of products
- (d) Life cycle costs
- (e) Recyclability
- (f) Environmental preferability
- (g) Waste prevention, including toxicity reduction
- (h) Disposal
- (i) Buy locally to minimize impact of transporting

## 2.7.5 Solid Surfaces

### 2.7.5.1 General

Solid surface components shall be solid, non-porous polymer, not coated, laminated or of composite construction. Materials shall have minimum physical and performance properties specified. Superficial damage to a depth of 2.54 mm (1/32 inch) shall be repairable by sanding or polishing.

### 2.7.5.2 Countertops and Window Sills

Material for countertops and interior window sills shall be standard 13mm (1/2 inch) thick. Surfaces shall not be affected by Class I reagents.

### 2.7.5.3 Color

Material shall be small scale, variegated pattern to the extent possible. Solid color solid surface material is strongly discouraged. Color should be light to medium tone as dark colors tend to show scratches and water spots more readily.

### 2.7.5.4 Sheen shall be matte satin.

### 2.7.5.5 Edge treatment for tops shall be eased, rounded edges.

#### 2.7.5.6 Performance Characteristics

##### 2.7.5.6.1 Fabrication

Components shall be factory fabricated to the greatest extent practicable to sizes and shapes indicated, in accordance with approved shop drawings. Joints shall be formed between components using manufacturer's standard joint adhesive. Defective and inaccurate work shall be rejected.

##### 2.7.5.6.2 Thermoforming

Thermoforming shall comply with manufacturer's product data. Molds shall be constructed of plywood in male/female sections matching component shapes. Molds shall be shaped prior to seaming and joining. Pieces shall be cut to finished dimensions with edges sanded and nicks and scratches removed. Heat the entire component uniformly between 135-191 degrees C (275-375 degrees F) during forming. Prevent blistering, whitening and cracking of solid polymer material during forming. Defective material shall be rejected.

#### 2.7.6 Laminated Plastic Tops

Continuous sheets of longest lengths practical shall be provided. Joints in surface sheeting shall be tight and flush and held to a practical minimum. When countertops and backsplash are one unit, PF42 plastic laminate shall be used. Plastic laminate shall conform to the requirements of NEMA LD 3 and plastic laminate adhesive shall be contact type applied to both surfaces. For fully formed and cove top countertops, the post-forming plastic laminate shall not be bent to a radius smaller than the limit recommended by the plastic laminate manufacturer.

#### 2.7.7 Vinyl Composition/Ceramic Tile/Floor Coating

##### 2.7.7.1 Vinyl Composition Tile

Vinyl composition tile shall conform to ASTM F 1066, Class 2, (through pattern tile), Composition 1, asbestos-free. Tile shall have the color and pattern uniformly distributed throughout the thickness of the tile. Flooring in any one continuous area shall be from the same lot and shall have the same shade and pattern.

2.7.7.1.1 Wall Base: Wall base shall be rubber cove.

2.7.7.1.2 Transition Strip: Transition strip shall be of vinyl plastic with a thickness to match flooring.

##### 2.7.7.2 Glazed Wall Tile

Ceramic tile shall conform to the requirements of ANSI A137.1. Glazed wall tile and trim shall be cushion edged with glazed finish.

##### 2.7.7.3 Ceramic Mosaic Tile

Ceramic mosaic tile and trim shall be unglazed porcelain with sharply formed face. Tile shall have with unglazed finish. Ceramic wall base

shall match the ceramic mosaic tile or the accent wall tile and shall have preformed corners.

#### 2.7.7.4 Trim Pieces

Conventional trim pieces are required, butt joints are not acceptable. Tile in vertical dimension shall be a whole tile. Wainscot height shall be adjusted to the nearest whole tile. Tile in horizontal dimension shall not be less than 3/4 of the manufactured dimension.

#### 2.7.7.5 ~~Hangar Floor Floor Coating (Hangar Floor)~~

**Hangar bay floors surface shall be hardened sealed concrete.** ~~Floor Coating shall consist of a pigmented, 2 component, 100 percent solids, capable of being placed by trowel or spray. Floor coating shall exhibit chemical resistance to chemical agents and solvents used in the hangar bays when applied in accordance with the manufacturer's instructions. These hazardous materials are described in the Material Safety Data Sheets (MSDS), see attachment. Color of the floor coating shall be the manufacturer's standard and be approved by the Contracting Officer. A sealer must be part of the floor coating system. Sealer shall be non slip and resistant to staining. Joints in coating and floor must match.~~

#### 2.7.8 Acoustical Ceilings

Acoustical ceiling tile shall conform to ASTM E 1264, Class A. Panel size shall be 600 mm x 1200 mm (2'x 4'). Recessed grid with drop-edge tile shall be used as the standard.

#### 2.7.9 Corner Guards and Chair Rails

**2.7.9.1** Chair rails/corner guards shall be used where wall abuse, wear and tear may occur. Chair rails/corner guards shall be provided with prefabricated end closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories standard with the manufacturer. End caps and corners shall be field adjustable to assure close alignment. Chair rails/corner guards shall consist of snap-on covers of resilient material mounted over continuous aluminum extrusion. Extruded aluminum retainers shall conform to ASTM B 2212, alloy 6063, temper T5 or T6. Chair rail/corner guard shall act as a shock absorber under impact without damaging wall to which it has been mounted.

**2.7.9.2** Colored components shall have integral color and shall match one another.

**2.7.9.3** To the maximum extent possible, the products shall be the standard products of a single manufacturer.

**2.7.9.4** Installation shall be in accordance with the manufacturer's written instructions.

#### 2.7.10 Interior Signage

Interior signage shall be fully integrated as a design element with the architecture and interior design. Signage for general office areas shall be modular to accommodate personnel changes or room function



changes. Where possible, international symbols are to be used. Emergency/fire evacuation plans shall be located at key areas to ensure fire safety. Signage plaque colors shall be compatible with the interior color scheme. All offices, including any electrical or mechanical spaces shall have room signs.

#### 2.7.11 Lockers

Lockers shall be steel with factory painted baked enamel finish. Lockers to be 381 mm wide x 1828 mm tall, double tier, with sloped tops and "Z" type metal base. Door frames to be formed channel shaped, welded and ground flush. Doors shall have reinforced channel edges, welded and ground smooth. Lockers to be furnished with integral locks.

#### 2.7.12 Toilet Partitions and Urinal Screens

2.7.12.1 Toilet partitions and urinal screens shall be solid surface solid plastic, conforming to FS RR-P-1352, Type I (partition) and Type III (screen).

2.7.12.2 Partitions shall be floor mounted, minimum 915 mm (36") clear apart for width of stalls.

2.7.12.3 All urinals shall have screens which shall be 457 mm (18") deep, wall mounted, minimum 711 mm (28") clear apart.

#### 2.7.13 Shelving.

2.7.13.1 Shelving in Janitor Room shall constructed of wood or metal and be supported by adjustable heavy duty steel brackets on wall. Two rows of shelving shall be provided, starting at 1850 mm (6'-2") above the floor, and going down towards the floor 400 mm (16") apart.

#### 2.7.14 Toilet/Janitor Accessories.

2.7.14.1 Glass mirrors shall be provided in toilet rooms in conformance with ASTM C 1036, Type I transparent flat type, Class 1 clear, Glazing Quality q1 6mm (1/4").

2.7.14.1.1 Small mirrors at single lavatory: Provide mirror 450 mm x 750 mm (18" x 30") above lavatory. Mirrors shall be provided with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames shall be 32 x 6 x 6 mm (1-1/4 x 1/4 x 1/4 inch) continuous at top and bottom of mirrors. Concealed fasteners of type to suit wall construction material shall be provided with mirror frames.

2.7.14.1.2 Full length mirrors at multiple lavatories: Provide mirror 1200 mm (48") high by full length of lavatory counter above lavatories. Frames for plate glass mirrors larger than 450 by 750 mm (18 by 30 inches) shall be fabricated from corrosion-resisting steel with satin finish. Frames shall be provided with concealed fittings and tamperproof mountings.

2.7.14.2 Combination paper towel dispenser and waste disposal shall be in conformance with CID A-A-2380. Provide semi-recessed, wall mounted,

stainless steel, near lavatory. Dispenser/receptacle shall have a capacity of 400 sheets of C-fold, single-fold, or quarter-fold paper towels. Waste receptacle shall be designed to be locked in unit and removable for service. Locking mechanism shall be tumbler key lock. Waste receptacle shall have a capacity of 45 liters (12 gallons). Unit shall be fabricated of not less than 0.8 mm (0.30 inch) stainless steel welded construction with all exposed surfaces having a satin finish. Waste receptacle that accepts reusable liner standard for unit manufacturer shall be provided.

2.7.14.3 Combination sanitary napkin/tampon disposer and seat cover/toilet tissue dispenser shall be wall or partition mounted, constructed of Type 304 stainless steel, with seat cover dispenser of a capacity of 200 seat covers. Toilet tissue dispenser shall have two rolls of tissue stacked vertically that shall be roller mounted on two support brackets. Brackets shall be stainless steel.

2.7.14.4 Combination seat cover and toilet tissue dispenser shall be wall or partition mounted, constructed of Type 304 stainless steel, with seat cover dispenser of a capacity of 200 seat covers. Toilet tissue dispenser shall have two rolls of tissue stacked vertically that shall be roller mounted on two support brackets. Brackets shall be stainless steel.

2.7.14.5 Liquid soap dispensers, counter-mounted (refillable from top of counter), with a vertical Type 304 stainless steel tank shall be in conformance with FS WW-P-541. Tank shall be with holding capacity of 0.94 L (32 fluid ounces) with a corrosion-resistant all-purpose valve that dispenses liquid soaps.

2.7.14.6 Mop and broom holder shall consist of approximately (2'-4") long, Type 304, stainless steel holder polished to a No. 4 finish, with 3 mop/broom holder clips.

2.7.14.7 All toilet accessories shall be securely fastened to the supporting construction.

#### 2.7.15 Window Covering

All offices, break rooms and administrative offices with exterior windows shall be provided with window coverings. Window coverings shall be metal horizontal or vinyl vertical blinds. Each blinds including hardware, accessory items, mounting brackets and fastenings, shall be provided as a complete unit produced by one manufacturer. All parts shall be one color, and match the color of the blind slat. Steel features shall be treated for corrosion resistance.

## 2.8 STRUCTURAL DESIGN

### 2.8.1 GENERAL

The Structural Engineer shall be responsible for the design of the complete structural system for the building. Complete structural system for the building shall include foundations, walls, floor and roof framing, floor and roof diaphragms, lateral load stability, framing and connection of any architectural features, and support of

mechanical and electrical equipment. **A different structural system may be utilized for each bay including "Pre-engineered" building.** The Structural Engineer is also responsible for the design of all lesser related structures such as utility vaults, pits, retaining walls, etc, although they may be shown on other discipline drawings. Structural design of the buildings shall be compatible with the architectural design shown on the plans.

## 2.8.2 DESIGN CRITERIA

### 2.8.2.1 Structural design shall be in accordance with the following design criteria:

ETL 00-05	Engineering Technical Letter: Seismic Design for Buildings and Other Structures
TI 809-01	Load Assumption for Buildings
TI 809-02	Structural Design Criteria for Buildings
TI 809-03	Structural Design Criteria for Structures Other than Buildings
TI 809-04	Seismic Design for Buildings
ASCE 7-95	American Society of Civil Engineers, Building Code Requirements for Minimum Design Loads for Buildings and Other Structures

**2.8.2.2.** Structure shall be designed to support actual dead loads plus all live loads and combinations according to the criteria in section 2.8.2.1.

**2.8.2.3.** Seismic Design shall be in accordance with the TI 809-4. The occupancy importance factor is 1.0. A narrative describing the proposed structure's lateral support system with specific details on seismic criteria and loads shall be submitted by the structural engineer.

**2.8.2.4.** Wind design shall be in accordance with the ASCE 7-95. Wind loads shall be based upon a 145-km/hr basic wind speed, importance factor = 1.0 and exposure type "C".

**2.8.2.5.** Ground snow loads shall be developed in accordance with TI 809-01 and the State of Utah design criteria. In case of conflicting requirements, the more stringent criteria shall govern. Drifting of snow shall be considered. Use 2.25 kPa (47 psf) for ground snow load.

**2.8.2.6.** **The paint bay structures where the optional telecranes to be added in the future shall be design to support three(3) telecranes in such a way that the three cranes will provide full airframe access.** Structures supporting cranes shall be designed in accordance with the TI 809-02, Section 7-3 (e). Support structures shall be designed to resist all loads induced into the structure by the cranes. Foundations, walls and roof structure shall be specifically

designed to resist gravity, lateral and impact loads induced by crane.

- 2.8.2.7. If the optional wash bay structure is configured to be a contiguous structure with the other bay(s), the adjacent structure(s) shall be designed in such a way that the wash bay can be constructed in the future without interrupting the facility operations and without altering the existing structure(s).**

### 2.8.3 CONCRETE DESIGN

2.8.3.1 All concrete design shall conform to the following codes and references:

American Concrete Institution (ACI 318-97)

- 2.8.3.2** Concrete shall have the minimum 28-day strengths specified in TI 809-02, Chapter 4. All reinforcing steel used in concrete shall be ASTM 615 Grade 60,  $F_y = 420$  MPa. **Concrete for hangar floor slabs subject to aircraft and mobile crane loadings shall have the minimum flexural strength of 66 MPa (650 psi).**
- 2.8.3.3** Footings shall bear on suitable natural soil or compacted structural fill as determined by geotechnical report. Footings shall be designed based on allowable bearing pressure determined by geotechnical report and shall be designed to resist sliding and uplift forces determined from lateral analysis. Exterior footings shall bear a minimum of 1000 mm below the exterior finished grade of the building. The continuous footings shall have a minimum width of 600 mm, and the spot footings shall have a minimum of 1000 mm by 1000 mm.
- 2.8.3.4** Thickened slab footings may be used in lieu of conventional footings under walls and partitions in accordance with TM 5-809-12/AFM 88-3, Chap. 15.
- 2.8.3.5** Hangar floor slabs shall be designed to support the design aircraft (C-130) and equipment loadings (mobile crane with a gross weight of 77,000 LB, 10,000 passes). The "keel" section, the middle section subject to C-130 aircraft loading in each hangar, shall be designed in accordance to the criteria specified in ~~Section 01011, Paragraph 2.1.8 (Pavement)~~ the Attachment #24, "GEOTECH REPORT FOR AIRFIELD PAVEMENT". The slabs outside of "keel" section in each hangar shall have a minimum thickness of 230 mm (9") for the mobile crane load. The base and subbase for all interior slabs subject to aircraft and mobile crane loadings shall be uniform throughout each hangar and shall be designed in accordance to the attachment #24 "GEOTECH REPORT FOR AIRFIELD PAVEMENT".
- 2.8.3.6** Unless otherwise specified in the Geotechnical Report, interior slabs on grade with floor covering shall be place over 100 mm sand on 0.15 mm polyethylene vapor barrier over 150 mm of capillary water barrier. Slabs shall not bear directly on footings, foundation walls, or column piers. At least 150 mm of fill cushion or capillary water barrier between the bottom of the slab on grade and the top of footings shall be provided. No slab on grade shall be

less than 150 mm thick. All slabs on grade shall be reinforced with a minimum 13-mm bar spaced at 450 mm on center each way.

- 2.8.3.7 All slabs on grade shall have crack control joints in accordance with TI 809-02, Chap.5 and TM 5-809-12/AFM 88-3, Chap. 15. The area of sections bounded by crack control joints may be construction joints, expansion joints or isolation joints and shall extend a minimum of 1/4 the depth of the slab. Re-entrant corners in slabs and all discontinuous control or construction joints will be reinforced with two 13 mm bars, 1200 mm long, placed diagonally to the corner.
- 2.8.3.8 All joints in concrete slabs shall be sealed with fuel resistant sealer.
- 2.8.3.9 Structural isolation pads shall be provided under all machinery, mechanical equipment.
- 2.8.3.10 All walls shall be designed to resist the gravity and lateral loads required by the design criteria. Embeds in wall panels shall be protected from weather and elements to prevent deterioration of the connections. All concrete wall shall be reinforced one(1) 19-mm bar minimum at the perimeter of the wall. All opening shall have lintel and column steel to the sides of all openings designed to transmit all forces around the openings. Reinforcing at all opening edges shall be one(1) 22-mm or two(2) 16-mm bar minimum.

#### 2.8.4 MASONRY DESIGN

- 2.8.4.1 Masonry design shall be in accordance with the TI 809-06, Masonry Design for Buildings.
- 2.8.4.2 All masonry design shall be per the following design stresses:

Concrete Masonry Units (CMU) . . .	f'm = 10.3 MPa (min.)
Clay Masonry Units . . . . .	f'm = 12.4 MPa (min.)
Mortar, Type M . . . . .	17 MPa
Grout, ASTM C476 . . . . .	14 MPa

All reinforcing steel used in masonry shall be ASTM 615, Grade 60.

- 2.8.4.3 All masonry wall shall be designed to resist the gravity and lateral loads required be the design criteria (section 2.8.1). All masonry wall shall be reinforced with one(1) 19-mm minimum at the perimeter of the wall. All openings shall have lintel and column reinforcing steel to the sides of all openings designed to transmit all forces around the openings. Minimum reinforcing at all opening edges shall be one(1) 22-mm or two(2) 16-mm bar.
- 2.8.4.4 All exterior masonry walls shall be grouted solid.

#### 2.8.5 STEEL DESIGN

- 2.8.5.1 All steel design shall conform to the latest issues of the following codes and references:

- AISC Manual of Steel Construction
- Steel Joist Institute
- Steel Deck Institute

**2.8.5.2** Steel shall be designed for the following working stresses:

Structural Steel

Hot Rolled Sections, ASTM A36 . . . . .	Fy = 248 MPa
Hot Rolled Sections, ASTM A572, Grade 50. . .	Fy = 345 MPa
Structural Tube, ASTM A500, Grade B . . . .	Fy = 317 MPa
Pipe, ASTM A53 Type E Grade B . . . . .	Fy = 241 MPa
Plates and Misc. Steel, ASTM A36 . . . . .	Fy = 248 MPa

Light Gage Cold-formed Steel

1.6 mm (16 GA) and heavier . . . . .	Fy = 345 MPa
1.3 mm (18 GA) and lighter . . . . .	Fy = 228 MPa

Steel Decking . . . . .	Fy = 228 MPa
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Bolts

In structural Steel . . . . .	ASTM A325M
In Cold-formed Steel . . . . .	ASTM A307
In Concrete or Masonry . . . . .	ASTM A307

**2.8.5.3** All steel joists shall be designed and manufactured per the Steel Joist Institute requirements. Joist shall be designed to have a maximum total load deflection of 1/240 of the joist span unless a smaller deflection is required by structural elements or equipment supported by the joist.

**2.8.5.4** All steel deck shall be galvanized (G-90) and shall conform to the requirements of the Steel Deck Institute.

**2.9** MECHANICAL PROCESS EQUIPMENT

**2.9.1** ENGINEERING REQUIREMENTS FOR THE DRY MEDIA  
BLASTING (DMB) EQUIPMENT FOR THE C-130  
DE-PAINTING HANGAR BAY

**2.9.1.1** General

The DMB facility, is to include hangar bay, and system integration/engineering requirements for the C-130 dry media blast (DMB) depainting hangar bay. The facility shall be configured for dual usage, DMB and washing. The facility shall be equipped with both in-floor dry media recovery systems and wash water floor trough and drains. All sections of the in-floor media recovery systems shall be provided with all necessary covers, seals, and drains to prevent water from entering during washing. All wash water troughs and drains shall be provided with all necessary covers and seals to prevent the entry of blast media during DMB operations. All interior surfaces and components including walls, ceilings, structural, mechanical/electrical enclosures, and mechanical/electrical fixtures in the DMB hangar bay shall be sealed and be able to be washed down with water without any water ingress or damage. This is to allow cleaning all interior surfaces of DMB media and dust accumulations. This requirement is for the DMB process hangar bay only

and does not include the DMB media processing equipment rooms. ~~The DMB bay shall be designed for a work force of 14 people per shift, 3 shifts per day.~~ A single observation booth shall be provided that looks into the hangar bay. The DMB hangar bay shall be NEC rated to accommodate fueled aircraft. This document assumes that a single material issue center (MIC) type facility, a single air compressor room, a single wet processes equipment room, and a single chemical storage/pump room are provided for all three bays (paint, wash, strip) as required. Note: All breathing and shop air stations in the facility, including all hangar bays and work/storage rooms, shall be provided with individual pressure regulators and gauges.

**NOTE: If the optional wash bay is deleted, the DMB bay must be capable of the aircraft washing requirements, including wash water ventilation, and be dual rated to accommodated fueled aircraft.**

**If the optional wash bay is not deleted, the aircraft washing capability, wash water ventilation system, and the dual rating for fueled aircraft is deleted from the DMB bay.**

**The wash bay ventilation system is deleted from the wash bay requirements.**

2.9.1.2 The DMB equipment shall be designed to use all USAF-approved plastic dry blast media and to clean the reclaimed media to current USAF T.O. 1-1-8 specifications. Good reusable media will range in size from 12 to 60 standard mesh. All media conveying, storage, and cleaning systems shall include all hoppers, receivers, air locks, level probes, controls, blowers, fans, motor starters, dust collectors, and any related items necessary for complete operating systems. All media conveying and transfer systems shall be pneumatic, no mechanical system shall be allowed. All media conveying pipes shall be equipped with easily removable long radius elbows (> 36" R). To help prevent clogs or plugging, all vertical or horizontal media transfer pipes shall be perpendicular or parallel to floor level respectively. No angling of transfer pipes relative to the horizontal floor level shall be allowed.

2.9.1.3 The DMB equipment shall be divided into two (2) identical but separate systems, located in 2 identical but separate equipment rooms. These equipment room shall be located in the areas in front of the right and left wings of the C-130, one on each side of the fuselage center line. All DMB equipment, with the exception of the dust collection systems for the DMB equipment, shall be located inside the two separate equipment rooms. The systems shall be totally self contained to operate independent of each other but shall provide the interlocks and controls as specified in this document to allow the to systems to work in concert together. Media storage capacity shall be a minimum of 22,680 KG. (50,000 Lbs.) of media in each equipment room.

2.9.1.4 The pneumatic media recovery systems for each equipment room shall consist of separate but identical systems: 3 each removable in-floor recovery duct sections and 2 manual hose vacuum hoses per equipment room. (i.e. 6 in-floor sections, and 4 manual vacuum hoses, total for the depaint bay). Each of the three (3) in-floor sections, at a minimum, shall be .9 m. (3 ft) wide by 7.5 m (25 ft) long. This shall provide a minimum of 21 sq. meters (225 sq. ft) per side, 42 sq. meters total. Each of the .9 m (3 ft) wide x 7.5 m. (25 ft) long sections shall be located adjacent to the C-130, in areas where media naturally accumulates during de-painting operations: 1. Along the side of the fuselage, forward

of the wing, 2. Along the side of the fuselage, aft of the wing, 3. Perpendicular to the fuselage, under the wing. The in-floor recovery sections and the associated hard-piping shall be designed such that if the entire floor section is filled with plastic media, blockage of the recovery floor sections, **and** the associated hard piping cannot occur.

**NOTE: As a potential cost reduction item, alternative "in floor" recovery systems may be proposed.**

2.9.1.4.1 The in-floor recovery sections shall be removable and shall be flush with the surrounding floor area. The floor sections shall be provided with a replaceable 4.5 mesh size hardened wire trash screen, and bare steel grating designed to support the weight of C-130, ~~A-10, and F-16~~ aircraft. The in-floor recovery sections shall be equipped with adjacent water drain troughs. Easily installed and removable covers shall be provided over the in-floor media recovery sections that direct any water away from the in-floor sections to water drain troughs away from the in-floor media recovery sections. Hard-piping shall be provided from the in-floor recovery sections to the equipment room in below floor level troughs, with sealed removable covers. These sealed hard-pipe troughs shall be as straight as possible, running from the in-floor sections to the equipment rooms. The hard-pipe trough covers shall be removable sealed diamond plate designed to support the weight of C-130, ~~A-10, and F-16~~ aircraft.

2.9.1.4.2 The 2 manual vacuum hoses on each side (4 total) shall be located to allow media recovery in areas outside the in-floor recovery sections. Suitable media recovery hose lengths shall be provided that allow the hose to reach from the end of any hard-piped sections, 6 meters (20 ft) past the center line of the wing and fuselage of the aircraft. Each of the two manual vacuum hoses shall be equipped with an easily moved and operated recovery tool. This tool shall have an easily replaceable 1.27 cm (1/2 in) mesh screen to prevent large debris from entering the vacuum hose. The media recovery hoses shall be designed such that if the entire inlet section is filled with plastic media, blockage of the flexible hose and the associated hard piping cannot occur.

2.9.1.4.3 The vacuum in-floor sections and media recovery hoses shall be provided by independent balanced vacuum source(s) that feed the recovered media into an initial recovery hopper. All media recovery systems feeding into this hopper shall have removable coarse 0.64 cm (1/4 in) grated clean-out drawer(s) to stop any large debris from entering the dirty media storage hopper. These drawers shall have a minimum of one (.093) sq. meters (1 sq. ft) of screen area. Any exhaust from the air or vacuum source shall be exhausted to the system dust collector.

2.9.1.5 The controls and indicators for the DMB equipment in each equipment room shall be divided into individual systems: 1. Media blasting, 2. Media recovery, 3. Media separation/cleaning. These controls shall be located in the observation room/office and shall provide for operator selectable independent operation of each system. Individual remote control of the blast pots in each equipment room shall provide adjustable air pressure, blast air on/off, ~~digital pressure readouts (psi), adjustable media mass flow rate, digital mass flow rate indicator (Lbs./Hr),~~ and media on/off to allow the blast air to be used for blow-down. A blast system master on/off switch shall be provided to turn on or off all blast pots in each equipment room. The media recovery systems for each equipment room shall provide for individual on/off control of each



of three systems: 1. The floor recovery sections 2. Media recovery hose #1 3. Media recovery hose #2. All equipment supplied as part of the media cleaning system will be operated with a single on/off switch. No operator-dependant on/off sequencing shall be acceptable. All safety and related DMB equipment process controls shall be interfaced as required to the media cleaning/separation system controls.

- 2.9.1.6 The media storage shall be divided into three (3) hoppers 1. Initial Recovery 2. Cleaning Equipment Accumulator 3. Clean Media Storage. All storage hoppers shall be completely sealed except for top mounted man access hatches. All hoppers shall have sight level glasses visible from the ground level such that the operator can visually see the level of plastic media in the hoppers. All hoppers shall have internal air-assisted flow aids to prevent plugging and bridging. Full, automatic re-start, and low level probes shall be provided as indicated in each hopper to stop and start media transfers, prevent overflow conditions, and indicated low media conditions. To minimize potential down time, eliminate the need for additional training, provide spare parts commonality, and maintain the established OO-ALC/TI maintenance/knowledge base of the existing DMB systems at OO-ALC, all level probes in the DMB system shall be of the following type:

Dynatrol Model CL-10DJ.  
Automation Products  
3030 Max Roy St.  
Houston TX 77008, (713)869-0361

The full level probes shall be installed in a location that is not affected by any media conveying systems and at a level a full point of 95% of the interior volume of the hopper. The automatic re-start level probes shall be installed at a lower level in the hopper to provide a re-start delay of the media conveying system. Low level probes shall be installed above the media outlets to indicate an empty of media state. All full, delay on, and low level probes shall have indicator lights on the control panel. All hoppers shall have media slide gate valves at their outlets to allow maintenance without requiring the hopper to be emptied of media.

- 2.9.1.7 All media recovery systems shall be designed with all required air locks such that the dirty media in the initial recovery hopper is stored at ambient pressure. The system hopper(s) shall be sized at a storage capability of media to allow uninterrupted recovery of media during the initial loading of media and/or after blasting, i.e. the system hopper(s) shall provide adequate buffer/storage capacity, and the media cleaning system throughput rate sized such that all recovery systems can be on at the same time and the initial recovery hopper will not reach a full state as long as the media cleaning system is on. A slide gate valve shall be provided at the outlet of the initial recovery hopper to allow maintenance without requiring the hopper to be emptied. Full, restart, and low level probes shall be provided as indicated to prevent overflow conditions, stop and start media transfers, and indicate empty media states. The upper level probe shall be installed in a location that is not affected by the media recovery system(s) and at a level a full point of 95% of the interior volume of the hopper. The full level probe shall stop all media recovery systems. The restart level probe shall be installed at a lower level in the hopper to provide a delay of the re-start of the media recovery systems. A variable-speed rotary

feeder/airlock shall be provided to set the media cleaning system throughput rate and control the feed rate of the media from the initial recovery hopper into the cleaning equipment accumulator hopper. The speed controller for the air lock shall be internally adjustable such that the external operator control may not be adjusted above the ~~2268~~ **1815** kg (~~5000~~ **4000**lb.) per. hour (per system) media feed rate. The controller shall have an input for starting and stopping the feeder based on the full level probe control from the cleaning equipment accumulator. Note: To prevent media from causing unwanted noise, all rotary air locks/feeders in the system(s) shall be made of cast iron and be of the type designed for, and have compressed air purge and the associated contained venting installed. Note: The piping for the purge and vent air shall be black or galvanized iron pipe.

2.9.1.8 A media transfer system and cleaning equipment accumulator hopper shall be provided as a buffer or storage of media feeding the media cleaning systems. A slide gate valve shall be provided at the outlet of the cleaning equipment accumulator. Any exhaust from the air or vacuum source from the media transfer system shall be exhausted to the system dust collector. Full, re-start, and low level probes shall be provided as indicated to prevent overflow conditions stop and start media transfers and indicate empty media states. The upper level probe shall be installed in a location that is not affected by the media transfer system and at a level a full point of 95% of the interior volume of the hopper. The full level probe shall stop the initial recovery hopper rotary feed valve and leave the transfer system on for a period to clear the transfer ducting feeding the accumulation hopper of media. The re-start level probe shall be installed at a lower level in the hopper to provide a delay of the re-start of the media transfer system and rotary feeder. A rotary feeder/airlock shall be provided to feed media from the cleaning system accumulator.

2.9.1.9 The output of the media cleaning equipment accumulator hopper shall pass through a slide gate cut-off and magnetic particle separator that shall have a minimum of two rows of staggered magnets. The slide gate valve will be used to stop media flow when the magnetic separator is removed for cleaning or for other maintenance operations. The magnets shall be mounted in an self-cleaning removable drawer to allow rapid and easy cleaning of all magnets. An ionized air injection system shall be provided at the outlet of the magnetic separator to help eliminate the build-up of static electric charge in the media.

2.9.1.10 A vibratory separator shall be provided at the outlet of the media cleaning equipment accumulator to separate large waste and fines from the recovered media. The screens shall be sized for separating good media ranging in size from 12 to 60 standard mesh size. All large waste and fines shall be sent to the system dust collector. The vibratory screen shall be provided with any required air locks to assure that there is no air flow or vacuum across the screens that may impact the operational efficiency. Internal ball type screen cleaners shall be provided with the vibratory separator. The output of the vibratory separator shall be into a heavy particle separator (HPS) to separate all dense particles from the recovered media. The HPS shall be a fluidized bed design. All heavy contaminants, exhaust, and dust generated by the HPS shall be sent to the system dust collector and all reusable media to the blast system hopper. The HPS shall be equipped with a control panel mounted bypass switch to allow deletion of the HPS from the process

flow, while retaining all other separation equipment and returning the reclaimed media to the blast system storage hopper. When the HPS is in the bypass mode the HPS will automatically clear of media and be turned off to reduce unnecessary wear on the system components. An HPS bypass indicator shall be provided on the control panel.

2.9.1.11 A media transfer system and clean media hopper shall be provided for transferring media from the HPS or HPS bypass to the clean media storage hopper above the blast systems. A full level probe shall be provided as indicated in a clean media hopper to stop and start media transfers and to prevent overfill conditions. The probe shall control the media cleaning and conveying equipment prior to the hopper. Upon a full condition, the controller shall stop the initial recovery hopper to rotary feed valve feeding media to the media cleaning equipment, but allow the vibratory separator, HPS, (only when in the process flow), and the transfer system to continue to run for a timed interval until the media cleaning equipment and transfer systems are clear of media. The upper level probe shall be installed a location that is not affected by the media conveying system and at a level a full point of 95% of the interior volume of the hopper. The re-start condition shall be an adjustable time delay from the level probe being uncovered by media to provide delay on the re-start of the media cleaning and conveying systems. The time interval shall be adjustable for time intervals of a minimum of five minutes to a maximum of 15 minutes. All media cleaning and conveying equipment shall re-start after this delay period. Five (5) each feed hoppers on each system, (ten total in the bay) with a minimum angle of 45 degrees and slide gate valves shall be provided over each blast pot outlet. Any exhaust from the air or vacuum source from the media transfer system shall be exhausted to the system dust collector.

2.9.1.12 The contractor shall provide ~~five (5)~~ **four (4)** blast systems in each of the two equipment rooms for a total of ~~ten (10)~~ **eight (8)** blast systems. The blast systems shall be single staged with pneumatic power pop up sealing valves that operate from the supply line pressure independent of pot pressure. To assure that no air pressure is discharge in to the media storage hopper, the pot blow down sequence shall be interlocked and timed such that the power pop up valves cannot open until all internal pot air pressure has been discharged out the normal pot blow down pipes i.e. the pop up valves shall not open while there is any internal above ambient pot pressure present. Any pot blow down or control air pressure exhausts to the ambient shall be provided with mufflers. If a potential for media leakage from any exhaust exists, the air lines shall be routed to the system dust collector such that no media is released into the environment during blow down or other normal blast pot operations. The blast pots shall be equipped with all necessary controls for operation of the blast systems. This will include all blast and control line hoses, dead mans, ~~pilot operated remote control~~ air pressure regulators, media flow control valves, and 1.27 cm (1/2 in) diameter blast nozzles.

2.9.1.13 The blast hose connections from each of the ~~five (5)~~ **four (4)** blast pots in the equipment rooms shall be hard-piped to a blast hose connection manifolds each located along the inside walls. A total of four (4), two (2) each per side, hard piped blast lines shall be provided. These four (4) hard piped blast lines shall allow blasting of the aircraft upper surfaces, one hard piped line per side, one (1) above each wing, and one (1) hard piped line per side, one on each side of the

tail surfaces. All manifold, nozzle, and hose couplings shall be aluminum. Plastic couplings shall not be allowed. These manifolds are to allow different hoses to be connected to each pot to access various surfaces of the aircraft as required. Each blast pot connection shall be provided with quick disconnects for both the blast hose and dead man control lines. The connections to each individual pot shall be grouped together and clearly marked with non removable stamped metal labels as to each pot number. Blast and dead man control line hoses, a minimum length of 38 m (125 ft) shall be provided with each manifold hookup. Blast nozzles shall be 1.27 cm (1/2 in) long venturi types. Breathing air hook-ups shall be provided at the connection manifold for each blast hose hook-up

- 2.9.1.14 A system dust collector separate from the ventilation system dust collector shall be provided for each of the DMB systems to collect all waste dust, exhaust air, and venting for all equipment associated with the DMB recovery, transport, cleaning, and blasting equipment. The dust collector filters shall be of pleated paper design with automatic reverse pulse jet (RPJ) cleaning. A screw feeder and/or airlock system shall be provided to automatically empty the dust collector to a single OO-ALC supplied pallet mounted bag container. The neck from this airlock for hook up to the collection bag shall be 30.5 to 46 cm (12 to 18 in) long with the end of this chute 127 cm (50 in) above ground level to provide adequate clearance for the bag and pallet. Any ventilation or conveying system air exhausted inside the equipment room shall be provided with high efficiency particulate air filter (HEPA)<sup>o</sup> filters to meet all applicable environmental, OSHA, AFOSH, and operator regulations. All ducting shall be provided with braided grounding straps between each section or joint
- 2.9.1.15 In addition to the breathing air hook-up at the blast hose manifold, 16 each combination breathing/shop air stations shall be located around the DMB hangar bay on the walls and floors. Note: the air volume required for inside the DMB hangar 708 clm (25 cfm) of breathing air per station, 850 clm (30 cfm) of shop air per station, 7,080 clm (250 cfm) blast air per blast hose.
- 2.9.1.16 All required utilities, systems, and equipment shall be provided in a dedicated wet process equipment room for the water based processes in the DMB hangar bay: A. 4 each hot water pressure washers B. ~~wash water recycling equipment~~ C. 4 each fresh water rinse hoses **(with heat exchangers and valves selectable for hot, cold, or mixed warm water)** ~~Note: the wash water recycling system shall be for recycling wash water only (i.e. soap and traces of other chemicals only). The recycling system shall supply water to the hot water pressure washers. 45.8 m (150 ft) hoses and retractable reels shall be provided in the DMB hangar bay for each process supply hose.~~ **NOTE: The wash water recycling system requirement is deleted.**
- 2.9.1.17 The floor surface shall drain to and be provided with floor troughs, drains, and all necessary plumbing to tie the DMB hangar bay to the existing industrial waste treatment plant (IWTP). These floor trough drains shall be provided with man accessible sumps, basins, and weirs to separate and allow removal of solid waste materials. Manually selectable valving shall be provided to direct the sump water to either the IWTP or to the wash water recycling system located in the wet process equipment room. These troughs shall be supplied with removable galvanized grating

to support C-130, ~~A-10, F-16~~ aircraft Easily removable covers shall be supplied to prevent the ingress of plastic media during DMB operations.

2.9.1.18 A changing room for a crew of 14 personnel is to be located between the hanger and restrooms/locker rooms. This room is to use by personnel while removing or donning the protective clothing and gear. This room is to be provided with benches for the personnel and hangers for the their protective equipment and gear. In addition, this room shall be provided with 100 percent clean conditioned air. All exhaust air from this room is to enter the main hanger. Prior to entering this room a dust removal area, near it's entrance, is to be provided. This area is to have a means to remove excess dust off the protective clothing. The entrance to the changing room shall have a means of preventing hanger air from entering the changing room.

2.9.1.19 Lighting shall be provided in the walls and ceilings of the DMB/wash hangar bay that shall illuminate all surfaces of a C-130 at 75 ft candles **per applicable subparagraphs of section 2.10.18.**

2.9.1.20 All DMB process equipment shall be interlocked with the facility fire alarm system.

2.9.2 REQUIREMENTS AND ENGINEERING SPECIFICATIONS FOR THE DRY MEDIA BLAST (DMB) DUST COLLECTION SYSTEM AND WASHWATER VENTILATION SYSTEMS FOR THE C-130 DE-PAINTING HANGAR BAY

2.9.2.1 General

The following are general facility and system integration/engineering requirements for the C-130 dry media blast (DMB) hangar bay. ~~The DMB bay shall be designed for a work force of 14 people per shift, 3 shifts per day.~~ A single observation booth shall be provided that looks into the DMB hangar bay. The DMB hangar bay shall be dual rated, NEC Class I and II, to accommodate fueled aircraft. This document assumes that a single material issue center (MIC) type facility, a single air compressor room, a single wet processes equipment room, and a single chemical storage/pump room are provided to supply all three bays (paint, wash, strip) as required. Note: All breathing and shop air stations in the facility, including all hangar bays and work/storage rooms, shall be provided with individual pressure regulators and gauges.

**NOTE: If the optional wash bay is deleted, the DMB bay must be capable of all aircraft washing, including wash water ventilation, and be dual rated to accommodated fueled aircraft.**

**If the optional wash bay is not deleted the aircraft washing capability, wash water ventilation system, and the dual rating for fueled aircraft is deleted from the DMB bay.**

2.9.2.2 The new dust collection equipment and wash water ventilation systems shall provide heated horizontal, aircraft front to rear air flow for dust control during the dry media blast (DMB) process, and shall ventilate the water spray and soap fumes to the outside during aircraft washing. These two "during process" functions shall be provided by two totally separate systems installed in the de-painting hangar. Note: At the option of contractor, the wash and dust collection systems may use a common system fan. No "dual use" of ducting that may contain dust shall be allowed.

2.9.2.2.1 The dust collection system shall use return or make up air for an end to end velocity of 18.3 m (60 ft) per minute at all points through the inside volume of the hangar. Corners and extreme areas of the hangar are not required to meet this velocity requirement. The clean return air ducting shall be provided with a manually operated damper and exhaust air bypass systems to provide a slightly negative pressure in the hangar. The return air ratio shall be less than 100% to provide a slightly negative pressure inside the hangar. The exhaust dampers and fresh air inlets shall be adjustable to direct from 0% to 20% to 100% of the cleaned exhaust air to the atmosphere with un-recirculated make-up air being pulled into the ducting by negative pressure. The return air shall be provided with a computer controlled heating system. All ducting, dampers, air handlers, additional piping, and plenums required to provide heating of the return air shall be provided. Thermostatic controls shall be provided to monitor the blast booth and shall be located at the observation booth. The booth internal temperature at floor level shall be required to be maintained at 21 °C (70 °F) across the width of the hangar with exterior ambient temperatures of -12 °C (10 °F) The dust collection system shall be for "dry" processes only, and shall be interlocked with the washing equipment such that the system can only be used when the washing equipment is off. All required ducting, dampers, fans, motors, motor starters, soft starts, foundations, wiring, heating systems, plumbing, and dust collectors shall be provided.

2.9.2.2.2 The dust collection system shall be provided with a dust collection system to contain the dust from the ventilation fan air flow. The dust collectors shall be of a down flow design and remove 99.8% of the .5 micron and larger dust from the booth air. The air cloth ratio shall not be greater than 2.4 to 1. The filters shall be pleated cartridge type and shall be fully replaceable. The filters shall be provided with a manometer to indicate a dirty filter condition, and shall be equipped with manometer controlled automatic reverse pulse jet type (RPJ) cleaning. Access doors and removable panels shall be provided to allow access for service and maintenance to the dust collector as required. Man access shall be provided to the clean air side of the dust collector. The dust collector shall be dust and watertight suitable for exterior installation and shall be provided with a concrete foundation. The dust collector and all ducting shall be equipped with all minimum required NFPA standard explosion venting and grounding. The explosion venting shall be directed away from the personnel area. All ducting shall be provided with braided grounding straps between each section or joint

2.9.2.2.3 The wash water ventilation system shall use return or make up air for an end to end velocity of 12.2 m (40 ft) per minute at all points through the inside volume of the hangar. Corners and extreme areas of the hangar are not required to meet this velocity requirement. The return air ducting shall be provided with manually operated damper and exhaust air bypass system(s) to provide a slightly negative pressure in the hangar. The return air ratio shall be less than 100% to provide a slightly negative pressure inside the hangar. The exhaust dampers and fresh air inlets shall be adjustable to direct from 0% to 20% to 100% of the exhaust air to the atmosphere with un-recirculated make-up air being pulled into the ducting by negative pressure. During cold weather, the return air shall be provided with a computer controlled heating system. During warm weather, the return air shall be exhausted to the outside. All ducting, dampers, air handlers, additional piping, and plenums

required to provide heating of the return air shall be provided. Thermostatic controls shall be provided to monitor the blast booth and shall be located at the observation booth. The booth internal temperature at floor level shall be required to be maintained at 21 °C (70 °F) across the width of the hangar with exterior ambient temperatures of -12 °C (10 °F). The wash water ventilation system shall be for "wet" processes only, and shall be interlocked with the DMB equipment such that the system can be used only when the DMB equipment is off. All required ducting, dampers, fans, motors, motor starters, soft starts, foundations, wiring, heating systems, and plumbing shall be provided.

**NOTE: If the optional wash bay is deleted, the DMB bay must be capable of all aircraft washing, including wash water ventilation, and be dual rated to accommodated fueled aircraft.**

**If the optional wash bay is not deleted the aircraft washing capability, wash water ventilation system, and the dual rating for fueled aircraft is deleted from the DMB bay.**

2.9.2.2.4 A single "ambient space" heating system shall provide comfort heating of the facility in cold weather when the DMB and washing processes are not in use, and only low air flow velocities are required to heat the facility. Air circulation fans shall be provided to assure that the heat from the ambient space heating system does not stratify. These distribution fans shall prevent excessive heat levels in the ceiling areas and low temperatures at floor levels.

2.9.2.2.5 All air intakes shall be designed with screening and at elevations in the bay that will not allow the entrance of any plastic media, water, or large debris. Clean or inlet air ducting shall be provided with directional louvers. All fans shall be provided with isolation concrete foundations and vibration isolators. Concrete foundations and vibration isolators shall be sized by the fan manufacturer. Variable frequency drives (VFD) shall be provided for the fans to allow adjustment of the air velocities **as required for the application**. On/off and speed **speed** controls **as required** for the dust collection, wash water, and ambient space ventilation systems shall be provided inside the observation booth.

2.9.2.2.6 All process equipment and the ventilation system shall be interlocked with the facility fire alarm system.

### 2.9.3 ENGINEERING REQUIREMENTS FOR THE C-130 PAINTING HANGAR BAY

#### 2.9.3.1 General

The following are general facility and system integration/engineering requirements for the C-130 painting hangar bay. ~~The paint bay shall be designed for a workforce of 14 people per shift, 3 shifts per day. A single office/observation booth shall be provided that looks into the paint hangar bay.~~ The paint hangar bay shall be NEC rated to accommodate fueled aircraft. This document assumes that a single material issue center (MIC) type facility, a single air compressor room, a single wet process equipment room, and a single chemical storage/pump room are provided for all three bays (paint, wash, strip) as required. Note: All breathing and shop air stations in the facility,

including all hangar bays and work/storage rooms, shall be provided with individual pressure regulators and gauges.

- 2.9.3.2 The paint hangar bay shall be designed with a minimum of ~~four (4)~~ **three (3)** each, all directional gantry mounted overhead tele-cranes with rotating work platforms. These platforms shall provide man access from ground level, (platform bottom max 12" AGL), to all upper surfaces of a C-130 at a minimum ~~(two (2))~~ **(one (1))** each for the wing/ forward fuselage, and two (2) each for the tail/empenage). Each of the platforms, at a minimum, shall be sized, rated, and provide safety lanyards and breathing/shop air for a minimum of four (4) operators, 708 cfm (25 cfm) breathing air and 850 cfm (30 cfm) shop air per operator, ~~and one (1) set of plumbing from the wet process/chemical storage tank/pump room: One (1) rinse water, one (1) alodine, one (1) brightener, one (1) soap.~~ The tele-cranes shall use contained support track-type, not serpentine-type festoon systems. The tele-cranes shall be aluminum for non-sparking, provide platform safety bumpers, and optical non-contact mast collision protection. An automatic emergency back up power system and breathing air capability shall be supplied to the tele-cranes to allow all personnel on the tele-cranes to have adequate breathing air and electric power to allow the tele-cranes to be lowered from any elevated position in the facility to ground level should building electric power be lost.
- 2.9.3.3 A ventilated paint mixing room with space for 4 each paint shakers, 6 each paint gun cleaning stations, and 2 each 208.2 liters (55 gal) gallon waste drums shall be provided. A minimum of 4 each breathing air outlets, 6 shop air outlets, 708 cfm (25 cfm) breathing air, 850 cfm (30 cfm) shop air per station, a 3.3 m (10 ft) long work table and ventilation hood shall be provided in the mixing room. Coordinate with electrical portion of RFP for other applicable considerations.
- 2.9.3.4 Lighting shall be provided in ~~the walls, floor, and ceiling of the bay that shall illuminate all surfaces of a C-130 at 100 ft candles~~ **per applicable subparagraphs of section 2.10.18.**
- 2.9.3.5 20 each combination breathing/shop air stations shall be located around the paint hangar bay on the overhead platforms/ walls/ and floors. Note: the air volume required for inside the paint hangar bay shall be for only 10 of these stations to be active at one time. (708 cfm (25 cfm) of breathing air per station, 850 cfm (30 cfm) of shop air per station).
- 2.9.3.6 All required utilities, systems, and equipment shall be provided from the facility chemical and wet process equipment room for the chemical and water based processes used in the paint hangar bay: Four (4) each wands from the facility hot water pressure washers, four (4) each fresh water rinse hoses **(with heat exchangers and valves selectable for hot, cold, or mixed warm water)**, four (4) each alodine supply hoses and wands from the chemical storage/pump room, four (4) each brightener supply hoses and wands from the chemical storage/pump room, four (4) each soap supply hoses the chemical storage/pump room, (4) each de-ionized water hoses from the facility wet process room. Retractable reels with 46 m (150 ft) hoses shall be provided in the paint hangar bay for each of these supplies. **Note: The chemical and pressure washer systems are option bid item.**
- 2.9.3.7 The floor surface shall drain to and be provided with floor troughs, drains, and all necessary plumbing to tie the paint hangar bay to the



existing industrial waste treatment plant (IWTP). These floor trough drains shall be provided with man accessible sumps, basins, and weirs to separate and allow removal of solid waste materials. Manually selectable valving shall be provided to direct the sump water to either the IWTP or to the wash water recycling system located in the wet process equipment room. These troughs shall be supplied with removable galvanized grating to support C-130, A-10, F-16 aircraft.

- 2.9.3.8 The ventilation system shall provide computer controlled heated, **evaporative** cooled, and humidified horizontal ~~laminar~~ **unidirectional** air flow (aircraft front to rear), to maintain temperature and humidity while removing paint over-spray and fumes from inside the hangar bay. **The ventilation system shall provide 100% filtered outside air, in a pull-through system configuration, exhausting the filtered booth air to the outside. The air flow for the paint hanger shall be a minimum of 100 FPM in an area within ten feet of the surface of aircraft being serviced. This is to be an average velocity of 100 FPM. This air is required to have a unidirectional flow front to back. The remaining volume of air within the hanger Door opening area outside this 10 foot working area, will have an average velocity of 60 FPM. Air flow is to maintain temperature and humidity while removing paint over-spray and fumes from inside the hangar bay. The ventilation system shall provide 100% filtered outside air, in a pull-through system configuration, exhausting the filtered booth air to the outside. The air flow will be tested with a C-130 aircraft in the booth. The outside air shall be provided with computer controlled heating, evaporative cooling, and humidification systems.**

~~The system shall provide for an end to end average velocity of 30.5 m/min (100 ft/min) in the paint hangar bay. This will be tested with a C-130 aircraft in the booth. Performance measurements shall be taken at 0.3 sq. m (1 sq. ft) cross section area around the aircraft to insure the proper air flow is met. of the hangar bay and the intake and exhaust duct work. Corners, 10 m (33 ft) out, and extreme areas of the hangar are not required to meet this velocity requirement. The outside air shall be provided with computer controlled heating, cooling, and humidification systems. Thermostatic controls shall be provided to monitor and control the ventilation system shall be located in the paint bay observation booth/office~~ **an easily accessible ground level location** The temperature and humidity are to be controlled in the bay between 24°C (75°F) and 29°C (85°F) Dry Bulb (DB), with a 18° C (65°F) Wet Bulb (WB). The mode cooling relative humidity in the bay is to be maintained between 10% and 60%. Heating is to maintain For the heating The painting envelope around the aircraft is to be maintained @ 21°C (70°F). The exterior ambient design temperatures are -12°C (10°F) to 33°C (92°F). The ventilation system shall provide a three (3) stage filtration system compliant with all U.S. Environmental Protection Agency (EPA) National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. This filtration system shall be equipped with a NESHAP compliant automated filter differential pressure monitor data logging system.

- 2.9.3.9 All air intakes shall be designed with filters to prevent the entrance of dust or debris. All ducting shall be provided with braided grounding straps between each section or joint. All fans shall be provided with isolation concrete foundations and vibration isolators. Concrete foundations and vibration isolators shall be sized by the fan manufacturer. Variable frequency drives (VFD) shall be provided for the

fans. On/off and speed controls for the ventilation system fans shall be provided inside the observation booth/office.

2.9.3.10 An ambient space heating system shall be used for comfort heating when other manual processes are being done in the hangar, and the dust collection/wash water ventilation systems are not on. Air circulation fans shall be provided to assure that the ambient space heating system does not stratify heat levels in the hangar. These fans shall distribute the heated hangar air to prevent excessive heat levels in the ceiling areas and low temperatures at floor levels.

2.9.3.11 All process equipment and the ventilation system shall be interlocked with the facility fire alarm system.

2.9.4 ENGINEERING SPECIFICATIONS FOR  
THE C-130 WASH HANGAR BAY (*option Bid Item*)

2.9.4.1 General

The following are general facility and system integration/engineering requirements for the C-130 wash hangar bay. ~~The wash bay shall be designed for a workforce of 14 people per shift, three shifts per day. A single observation booth/office shall be provided for the wash hangar bay.~~ The wash hangar bay shall be NEC rated to accommodate fueled aircraft during all operations. This document assumes that a single material issue center (MIC) type facility, a single air compressor room, a single wet process equipment room, and a single chemical storage/pump room are provided for all three bays (paint, wash, strip) as required. Note: All breathing and shop air stations in the facility, including all hangar bays and work/storage rooms, shall be provided with individual pressure regulators and gauges.

2.9.4.2 All required utilities, systems, and equipment shall be provided from the facility chemical and wet process equipment room for the chemical and water based processes used in the wash hangar bay: Four (4) each wands from the facility hot water pressure washers, four (4) each fresh water rinse hoses (**with heat exchangers and valves selectable for hot, cold, or mixed warm water**), four (4) each alodine supply hoses and wands from the chemical supply/pump room, four (4) each brightener supply hoses and wands from the chemical supply/pump room, four (4) each soap supply hoses the chemical supply/pump room. Retractable reels with 46 m (150 ft) hoses shall be provided in the wash hangar bay for each of these supply hoses. Coordinate with electrical portion of RFP for other applicable considerations.

2.9.4.3 Lighting shall be provided in the walls and ceilings of the wash hangar bay that shall illuminate all surfaces of a C-130 at 75 ft candles **per applicable subparagraphs of section 2.10.18..**

2.9.4.4 Twenty (20) each combination breathing/shop stations shall be located along the wash hangar bay walls (708 clm (25 cfm) of breathing air per station, 850 clm (30 cfm) of shop air per station).

2.9.4.5 The floor surface shall drain to and be provided with floor troughs, drains, and all necessary plumbing to tie the wash hangar bay to the existing industrial waste treatment plant (IWTP). Manually selectable valving shall be provided to direct the sump water to either the IWTP or

to the wash water recycling system located in the wet process equipment room. The floor trough drains shall be provided with man accessible sumps, basins, and weirs to separate and allow removal of solid waste materials. These troughs shall be supplied with removable galvanized grating to support C-130, A-10, and F-16 aircraft.

~~2.9.4.6 The wash bay ventilation system shall use return or make up air for an end to end velocity of 12.2 m (40 ft) per minute at all points through the inside volume of the hangar. Corners and extreme areas of the hangar are not required to meet this velocity requirement. The return air ducting shall be provided with manually operated damper and exhaust air bypass system(s) to provide a slightly negative pressure in the hangar. The return air ratio shall be less than 100% to provide a slightly negative pressure inside the hangar. The exhaust dampers and fresh air inlets shall be adjustable to direct from 0% to 100% of the exhaust air to the atmosphere with un recirculated make up air being pulled into the ducting by negative pressure. During cold weather the return air shall be provided with a computer controlled heating system. During warm weather, the return air shall be exhausted to the outside. All ducting, dampers, air handlers, additional piping, and plenums required to provide heating of the return air shall be provided. Thermostatic controls shall be provided to monitor the blast booth and shall be located at the observation booth. The booth internal temperature at floor level shall be required to be maintained at 21°C (70°F) across the width of the hangar with exterior ambient temperatures of 12°C (10°F). All required ducting, dampers, fans, motors, motor starters, soft starts, foundations, wiring, heating systems, and plumbing shall be provided.~~

2.9.4.7 All air intakes shall be designed with screening to prevent the entrance of large debris. All ducting shall be provided with braided grounding straps between each section or joint. All fans shall be provided with isolation concrete foundations and vibration isolators. Concrete foundations and vibration isolators shall be sized by the fan manufacturer. Variable frequency drives (VFD) shall be provided for the fans **as required for this application**. On/off and speed **other** controls **as required** for the ventilation system fans shall be provided **in an easily accessible, non-hazardous, within sight ground level location**. ~~inside the observation booth/office~~

2.9.4.8 An ambient space heating system shall be used to maintain the temperature of the hangar for comfort heating for other manual processes done in the hangar. Air circulation fans shall be provided to assure that the ambient space heating system does not stratify heat levels in the hangar. These fans shall distribute the heated hangar air to prevent excessive heat levels in the ceiling areas and low temperatures at floor levels. The ambient space heating requirement may be met by the main ventilation system by using the VFD to reduce the air velocity.

2.9.4.9 All process equipment and the ventilation system shall be interlocked with the facility fire alarm system.

2.9.5 REQUIREMENTS FOR THE MATERIAL ISSUE CENTER (MIC),  
WET PROCESS, AIR COMPRESSOR, CHEMICAL DISTRIBUTION,  
AND PAINT MIXING ROOMS FOR THE C-130 HANGAR BAYS

2.9.5.1 General

These equipment rooms shall provide services and/or utilities to and from each hangar bay as required. These facilities shall be provide with all required and rated storage, floor space, power distribution, wiring, utilities, service access, lighting, breathing air, shop air, ventilation/cooling/heating, fire warning/protection, valving, plumbing, pumps, and controls.

#### 2.9.5.2 Material Issue Center (MIC)

The MIC room(s) shall be used to store all necessary materials and consumables, flammables and combustibles, solvents, paints, provide controlled material issue, provide room for a stencil/template fabrication area, and to act as a clothing and personal protective equipment (PPE) and tool storage/issue crib for all three bays. Storage for all materials and equipment shall be provided with all required safety, ventilation, and environmental systems.

#### 2.9.5.3 Air Compressor, Dryer, and Breathing Air

The air compressor, dryer, breathing air room(s) shall provide the compressed air for the facility. At a minimum it shall provide ~~four (4)~~ **two (2)** each 300 HP electric air compressors (**Note: An additional third 300 HP compressor is requested as an option**), all required closed loop compressor cooling system, refrigerated air dryers, coalescing and particulate filters, air receiver tanks, breathing air purifiers with CO monitors and alarms. Note: All required process equipment interlocks, and audio and visual CO alarms shall be provided in all bays and at all facility breathing air stations. Access **and space for three (3) ea. 300 HP compressors shall be provided** in the air compressor room to remove and maintain all **required (base bid two and option third)** compressors, dryers, **filters, and** controls shall be provided. Access into the air compressor room via a roll up door sized for these requirements and for forklift access shall be provided. All necessary plumbing and valving for hook up of external back-up compressor(s) for the facility supply shall be provided. Note: All breathing and shop air stations in the facility, including all hangar bays and work/storage/equipment rooms, shall be provided with individual pressure regulators and gauges at the point where the operator attaches their equipment.

#### 2.9.5.4 Pressure Washer, ~~Wash-water Recycling~~, De-ionized Water (**Note: The pressure washers and de-ionized systems are option bid items**)

This pressure washer, ~~wash-water recycling~~, and de-ionized room(s) shall provide the wet process equipment room for the water based processes as required in each hangar bay. At a minimum, it shall provide six (6) each hot water pressure washers. The pressure washers shall be capable of manual selection of both hot water only spray and automatically mixing the hot water spray with a soap concentrate from a 208 l (55 gal). drum. These pressure washers shall be hard plumbed to the hose reels in each bay with manually selectable valving in the wet process room such that any combination of the six (6) pressure washers, up to a maximum of four (4) can be used in any one bay at a time (i.e. 4/1/1, 4/2/0, 3/2/1, 3/3/0, 2/2/2). The on/off controls and thermostats for the pressure washers shall be located in the wet process equipment room. Space shall be left around each pressure for locating a 208 l (55 gal). drum of soap concentrate adjacent to each pressure washer.

~~A facility wash water recycling system with all required pumps, valves, dirty/clean water storage tanks to recycle wash water from all three (3) bays wash water troughs. Note: the wash water recycling system shall be for recycling wash water only (i.e. no large amounts of hydrocarbons, alodine, brightener, chemical stripper, etc). The system shall be required to recycle aircraft wash water with mainly soap and water with only small residual amounts of the other chemicals/contaminates in the water. All required plumbing and valving shall be provided to allow individual manual selection of either fresh or recycled water from the storage tanks to be supplied to each of the six (6) pressure washer systems.~~

A de-ionized water system with all required pumps, valves, storage tanks shall be provided to supply de-ionized water to the four (4) outlets to the paint bay. The de-ionized water system shall have a minimum storage capacity of 2000 gallons, with a maximum replenishment interval of the stored volume within 24 hours. Each of the four (4) hoses shall have a minimum delivery rate of fifteen (15) GPM. The water delivered by each hose shall be one hundred twenty (120) degrees F. The system shall provide de-ionized soft water maintained at 1 Meg Ohm, .5 PPM total dissolved solids (TDS).

Access in the pressure washer, ~~wash water recycling~~, and de-ionized water system room to remove and maintain all equipment shall be provided. Access into the pressure washer/recycling room shall be via a roll up door sized for these requirements.

2.9.5.5 Chemical Storage/Pump **(Note: The chemical storage pump systems are option bid items)**

The chemical storage and pump room(s) shall provide all equipment for processing three (3) each C-130 aircraft. Approximate minimum volumes of the tanks are: Alodine: 946 l (250 gal), Brightener: 946 l (250 gal), Soap: 946 l (250 gal). Note: the alodine and brightner tanks shall be supplied with built in internal agitators. An agitator is not required in the soap tank. All required secondary containment shall be provided. All required chemically rated plumbing/ pneumatic pumps/ valves/ accumulators shall be provided to supply the chemicals to the required facility locations. Access in the chemical storage and pump room to remove and maintain all tanks, pump, controls shall be provided. Access into the chemical storage and pump room shall be via a roll up door sized for these requirements. The chemical storage rooms shall have recessed below grade level floors to contain spills and leaks. Floor drains leading to the industrial waste treatment plant (IWTP) shall be provided in all chemical storage rooms. The drain pipes shall be provided with remote hand cut-off valves to stop or limit the feed of any spills to the IWTP. All chemical tanks shall be provided with retaining dikes.

2.9.5.6 Paint Mixing Room

The ventilated paint mixing/ gun/pot cleaning room(s) shall provide space for a minimum of four (4) each paint shakers, six (6) each paint gun/pot cleaning stations, and two (2) each 946 l (55 gal) waste drums. A minimum of four (4) each breathing air outlets, six (6) shop air outlets, (708 cfm (25 cfm) breathing air, 850 cfm (30 cfm) shop air per station), a 3.5 m (10 ft) long work table and ventilation hood shall be provided. Note: This paint mixing room shall be adjacent to and

directly accessible to the paint hangar bay.

#### 2.9.6 Heating, Ventilating, and Air Conditioning

##### 2.9.6.1 General

HVAC systems shall be sized in accordance with ASHRAE standards and comply with NFPA 90A and 90B. The analysis and design should be based on the energy conservation criteria of the latest edition of ASHRAE Standard 90.1 and 90.2 unless specified otherwise in this document. Additional referenced standards shall include the Uniform Building Code (UBC), Uniform Mechanical Code, applicable Occupational Safety and Health Act (OSHA) regulations, and the Mechanical and Electrical Seismic Protection parts of this document. All information technology items shall be Year 2000 compliant, which means that information technology shall accurately process date/time data (including, but not limited to, calculating, comparing and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 leap year calculation. Furthermore, Year 2000 compliant information technology, when used in combination with other information technology, shall accurately process date/time data if the other information technology properly exchanges date/time data with it. A service platform and access ladder shall be provided for equipment installed where the underside of the equipment is more than 3 meters (10 feet) above the floor.

##### 2.9.6.1.1 All Rooms, except, mechanical, Electrical room, toilets, janitors room, vestibule, stairwell and hanger bays.

These areas shall be conditioned.

##### 2.9.6.1.2 Toilets and janitors rooms

These areas shall be indirectly conditioned by drawing air from the adjacent corridor by ceiling mounted exhaust fans. The exhaust air shall be discharged through a roof mounted hood.

##### 2.9.6.1.3 Electrical Room

This room shall be conditioned by drawing outside air through a wall louver, with a duct running from the wall louver to the electrical room. An exhaust fan shall then exhaust room air directly to the outside. A room thermostat, set for 30°C (85 °F), shall control the fan.

##### 2.9.6.1.4 Internal Loads

The proposer shall be responsible for determining the correct internal loading from equipment and people. However, the following information is offered as guidance. The facilities designed around a 24-hour operation. The number of people in each Break-room/lunchroom is to be 20. The number of personnel in dry media blast and paint booth is to be 15. A minimum of 300 watts shall be assumed as equipment load for each desktop personal computer, and 50 watts shall be assumed for each laptop computer. The total building occupancy is 25 people.

##### 2.9.6.2 Heating

Heating loads shall be calculated in accordance with the latest edition of the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals. The calculation shall include a minimum 30 percent safety factor. Heating calculations shall exclude heat gains from internal and solar effects. All rooms shall be heated except for the vestibules, electrical rooms, and mechanical rooms. ***The Dry Media Blast Facility shall not have a direct source flame in the path (direct contract) of the conditioned air.***

#### 2.9.6.2.1 Design Conditions, Heating:

Elevation	1,280 m
Heating Degree Days (Based on 18 Degrees C)	3,378
97.5% Dry Bulb Ambient	-12.2 Degree C
General Office/Break-room Spaces	20 degree C
General Circulation Areas, Lobbies, Corridors and stairwells	20 Degree C
Toilets and Showers	20 Degree C
Electrical(exterior wall)	10 Degree C
Mechanical/Equipment Rooms	10 Degree C

#### 2.9.6.3 Air Conditioning

Cooling loads shall be calculated in accordance with the latest edition of the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals. The calculation shall include a minimum 10 percent safety factor. Cooling calculations shall be based on either the Transfer Function Method or the Cooling Load Temperature Difference/Cooling Load Factors Method. All rooms shall be air conditioned except for the vestibules, toilets, electrical rooms, stairwells, mechanical room, paint storage, and aircraft bays. The Paint bay is to be evaporation cooled in summer and humidified ,(if required), in winter.

##### 2.9.6.3.1. Design Conditions, Cooling:

Elevation	1,280 m
Cooling Degree Days (Based on 18 Degrees C)	511
2.5% Dry Bulb/Wet bulb Ambient	33.3/17.8 Degree C
Air Cooled condenser Ambient Dry Bulb	33 Degree C
General Office Spaces, Lobbies, Corridors	25.6 Degree C
Mechanical/Equipment, and Electrical Rooms	Ventilation Only

Aircraft Paint Bay only is to be controlled using evaporative cooling. See engineering requirements for the paint bay, for the design values.

#### 2.9.6.4 Ventilation

Ventilation air quantities shall be in accordance with ASHRAE Standard 62, Ventilation for Acceptable Air Quality.

#### 2.9.6.5 Energy Analysis

The Contractor's designer shall perform a building energy analysis using a professionally recognized and proven computer program that allows for the integration of architectural features with heating, air conditioning, lighting, and other energy consuming systems. The program shall be capable of simulating the features, systems, and thermal loads used in the design. Using established weather data files, the program shall perform, as a minimum, typical or average days-per-month calculations to determine such features and systems which will result in the lowest energy usage. The Design Energy Target for Facility Type "U1", Maintenance (Hangers, Tac. Shops, Docks), Weather Region 6, is 762,750 kJoules/sq.m/yr. (67,500 BTU/SF/Yr.), based on 24 hours per day, 5 days per week operation. These values reflect recent reductions made to the published DET values. Do not include process loads such as computers, photocopiers, etc., in this calculation.

#### 2.9.6.6 Materials and Equipment

Materials and equipment shall be standard catalog products of manufacturers regularly engaged in production of such materials. All selected equipment shall be manufacturer's latest standard model. Exterior equipment shall be factory primed and field painted per drawing requirements. Interior equipment shall be factory finished.

#### 2.9.6.7 Submittals

Submittals shall be provided by the Contractor to the Contracting Officer for approval in accordance with Specification Section: 01330 SUBMITTAL PROCEDURES which is included in this document in the Technical Specifications of the Statement of Work.

##### 2.9.6.7.1 Calculations, Drawings, and Specifications

Purchase and Installation of the HVAC equipment shall not begin until such time that all the calculations, drawings, and specifications have been approved as required in Section 01330. The calculations and drawings shall be prepared and stamped by a registered professional mechanical engineer, who is licensed to practice in a state or possession of the united states, puerto rico, or district of columbia.

##### 2.9.6.7.2 Operation & Maintenance (O&M) Manuals

Six (6) complete copies of the O&M manuals in bound 216 mm by 279 mm booklets shall include a brief description of all equipment and their basic operating features, piping and equipment layouts, the manufacturer's name, model number, service manual, parts list and simplified wiring and control diagrams of the systems as installed. In addition, the booklets shall list step-by-step procedures required for system startup, operation, shutdown, routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide.

#### 2.9.6.8 Construction Quality Control (QC)

QC shall require the Contractor to perform inspections, testing, and reporting. QC for all mechanical equipment shall be implemented as specified in Specification Section: 01440 CONSTRUCTION QUALITY CONTROL



which is included in this document in the Technical Specifications of the Statement of Work.

#### 2.9.6.9 Factory Fabricated Makeup Air Handling Units (AHU)

Units shall include fans, chilled water coils, airtight insulated casing, panel pre-filters, 80-85% final filters, adjustable V-belt drives, belt guards for externally mounted motors, access sections, pocket filter box, vibration isolators, and appurtenances required for specified operation. Vibration isolators shall be unhusd spring type. AHU shall have published ratings based on tests performed in accordance with ARI 430.

##### 2.9.6.9.1 Casings

All casing sections shall be constructed of a minimum 1.3 mm thick galvanized steel, or 1.3 mm thick steel outer casing protected with a corrosion resistant paint finish. Casing shall be sized and constructed with an integral structural steel frame such that exterior panels are non-load bearing. Exterior panels shall be individually removable. Removal shall not affect the structural integrity of the unit.

##### 2.9.6.9.2 Access

Casings shall be provided with inspection doors, access sections, and access doors. Inspection and access doors shall be insulated, fully gasketed, double-wall type, of a minimum 1.3 mm thick outer and 1.0 mm thick inner panels. Doors shall be rigid and provided with heavy duty hinges and latches. Inspection doors shall be a minimum 305 mm wide by 305 mm high. Access doors shall be minimum 710 mm wide and shall be the full height of the unit casing or a minimum of 1.8 m, whichever is less. A latched and hinged inspection door, shall be provided, as a minimum, in the fan, filter, and coil sections.

##### 2.9.6.9.3 Direct Fired Make-Up Air Heaters

Heaters shall be in accordance with ANSI Z83.4. Direct fired make-up air heaters use outside air directly ducted to the heater. The products of combustion generated by the heater are released into the outside air stream being heated. Heaters shall be equipped with backdraft dampers, bird screen. Gas control valve shall be modulating type. Outdoor heaters shall be weatherized and shall have manufacturer's standard exterior finish for outdoor units. ***The Dry Media Blast Facility shall not have a direct source flame in the path (direct contract) of the conditioned air.***

##### 2.9.6.9.4 Insulation

Each casing section handling conditioned air shall be insulated with not less than 25 mm thick, 40 kilograms per cubic meter density coated fibrous glass material having a thermal conductivity not greater than 0.034 Watts/m/degree C at a mean temperature of 10 degrees C. Factory applied fibrous glass insulation shall conform to ASTM C 1071, except that the minimum thickness and density requirements do not apply, and shall meet the requirements of NFPA 90A. Foam-type insulation is not acceptable. Foil-faced insulation shall not be an acceptable

substitute for use on double-wall access doors and inspection doors. Duct liner material, coating, and adhesive shall conform to the flame spread and smoke developed ratings in accordance with NFPA 101, NFPA 90A, AND NFPA 90B. Exposed insulation edges and joints where insulation panels are butted together shall be protected with a metal nosing strip or shall be coated to conform to meet erosion resistance requirements of ASTM C 107.

2.9.6.9.5 AHU Fans: For AHU fans, see paragraph: Fans.

#### 2.9.6.10 Reheat Coil

Hot water coils shall be fin and tube type constructed of seamless copper tubes and copper or aluminum fins mechanically bonded or soldered to the tubes. Headers shall be constructed of cast iron, welded steel, or copper. Casing and tube support sheets shall be 1.6mm (16 gauge), galvanized steel, formed to provide structural strength. Coils shall be tested at the factory to not less than 1700 KPa (250 psi) air pressure and shall be suitable for 1420 Kpa (206 psi) working pressure. Coils shall be drainable, and shall conform to ARI 410.

#### 2.9.6.11 Air Distribution

The systems provided shall conform to the recommendations of the ASHRAE Air Distribution Manual and SMACNA-06 Duct Construction Standards - Metal and Flexible and shall be designed so as not to permitted, under any circumstances, an exchange of air from one area with another area.

##### 2.9.6.11.1 Ductwork

Ductwork shall be constructed of galvanized steel for general ventilation and supply/return air use. Elbows shall be radius type with a centerline radius of 1-1/2 times the width or diameter of the duct. Ductwork from the discharge of the main variable volume AHU and the inlet of Air Terminal Units shall be constructed for static pressure class 1000 (4 inch water gauge) minimum. Return ductwork for the VAV system shall be constructed for a pressure class of negative 500 Pa. The remainder of the ductwork shall be constructed for a pressure class of 250 Pa.

##### 2.9.6.11.2 Duct Sealing

Static pressure class 125, 250, and 500 kPa shall meet the requirements of Seal Class C. Class 750 through 2500 shall meet the requirements of Seal Class A. Sealant, adhesives, coatings, and other accessories shall have flame spread and smoke developed ratings in accordance with NFPA 101, NFPA 90A, and NFPA 90B. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct and flat oval duct connections shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods as indicated by SMACNA-06.

##### 2.9.6.11.3 Duct Runouts

Individual runouts to diffusers and registers in rooms with ceilings may be constructed of factory pre-insulated flexible ducts which shall not exceed 3 m in length. Runouts to registers or grilles in toilets,

shower areas, and janitor rooms shall be metal.

#### 2.9.6.11.4 Acoustical Duct Lining

Acoustical lining shall conform to the requirements of ASTM C 1071, Type I and II and shall be factory fabricated fibrous glass designed exclusively for lining ductwork. Lining shall be provided on the discharges of all air handler supply fans and intakes of all return and exhaust fans.

#### 2.9.6.11.5 Diffusers

Diffusers shall be louvered or perforated face type with fully adjustable pattern and removable face. Diffusers shall be fabricated from steel, have a baked enamel finish, and be provide with opposed blade dampers and air straighteners. Diffusers in T-Bar ceilings shall be the panel type and be provided with 90-degree round neck adapters.

#### 2.9.6.11.6 Registers

Supply register blades shall be spaced on 19 mm centers with each blade being individually adjustable. Supply register shall be fabricated from aluminum with factory clear lacquer finish and shall be provided with an opposed blade damper. Supply registers shall be minimum four-way directional control type with vertical front and horizontal rear deflection blades. Return and exhaust registers shall as specified above for supply registers except without the horizontal rear deflection blades.

#### 2.9.6.11.7 Grilles

Ceiling grilles in acoustical T-Bar ceilings shall be the eggcrate type with 13 mm by 13 mm by squares. Grilles shall be fabricated of aluminum with a baked enamel finish. Ducted return grilles shall be provided with opposed blade dampers. Grilles shall be the panel type and sized to match the T-Bar ceiling grid.

#### 2.9.6.11.8 Duct Smoke Detectors

Duct smoke detectors shall conform to the requirements of UL 268A. Duct smoke detectors shall have perforated sampling tubes extended into the air duct. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset, which shall be made available at the fire alarm control panel. Detectors shall be rated for air velocities that include air flows between 2.5 m/s and 20.0 m/s. Detectors shall be powered from the HVAC control panel. Detectors shall have two (2) sets of normally open alarm contacts and two (2) sets of normally closed alarm contacts. Detectors shall be connected to the building fire alarm panel for alarm initiation. A remote annunciation lamp shall be provided for duct detectors that are mounted 2.4 m or more above the finished floor and for detectors that are not readily visible. Remote lamps and switches as well as each affected fan unit shall be properly identified in etched rigid plastic placards

#### 2.9.6.11.9 Fire Dampers

All duct penetrations into multi-floor vertical shafts shall be protected with a fire damper per NFPA-90A. With the exception of vertical shafts, all duct penetrations through one (1) hour rated walls shall not require a fire damper as per NFPA-90A.

#### 2.9.6.12 Hydronic System

The space heating hydronic system shall be a reverse return system if economical, however, a direct return is also acceptable. The chilled water system may be direct return. Isolation valves, inlet strainers, 2-way or 3-way valves, and calibrated balancing valves shall be provided on all hot water coils. The same shall apply to chilled water coils, except that all control valves shall be 3-way. Pressure relief and/or 3-way valves on some air terminal units shall be provided to avoid circulating pump "dead heading." Branch isolation valves shall be provided where three or more air terminal units connect to the main hot water supply and return piping.

##### 2.9.6.12.1 Cooling Coils

Coils shall be fin-and-tube type constructed of seamless copper tubes and copper fins mechanically bonded or soldered to the tubes. Casing and tube support sheets shall be not lighter than 1.6 mm thick galvanized steel formed to provide structural strength. When required, multiple tube supports shall be provided to prevent tube sag. Each coil shall be tested at the factory under water at not less than 2,750 kPa air pressure and shall be suitable for 1,375 kPa working pressure. Coils shall be mounted for counterflow service. Coils shall be rated and certified in accordance with ARI 410. Coils shall be installed with a pitch of not less than 10 mm per meter of the tube length toward the drain end. Headers shall be constructed of cast iron, welded steel or copper. Each coil shall be provided with a plugged vent and drain connection extending through the unit casing.

2.9.6.12.2 Heating Hot Water Piping: Fittings for copper tubing shall be made with silver solder or wire solder of 95 percent tin and 5 percent antimony (95-5). Piping shall not be run in or through the ductwork. Heating hot water shall be either Schedule 40 black steel or Type L hard-drawn copper. Fittings for steel pipe 25 mm in diameter and smaller shall be threaded; fittings 32 mm in diameter through 65 mm in diameter shall be either threaded, grooved, or welded; fittings 80 mm in diameter and larger shall be either flanged, grooved, or welded. Grooved mechanical joints shall be suitable for 860 kPa working pressure and 120 degrees C working temperature.

2.9.6.12.3 Water Treatment: Water to be used in the hot water systems shall be treated to maintain the conditions recommended by the manufacturers of the chiller and boiler. Chemicals shall meet all required federal, state, and local environmental regulations for the treatment of hydronic systems. Chemicals shall be environmentally suitable for direct discharge to the sanitary sewer. The services of a company regularly engaged in the treatment of water systems shall be used to determine the correct chemicals required, the concentrations required, and the water treatment equipment sizes and flow rates required. Acid treatment and proprietary chemicals shall not be used.

#### 2.9.6.13 Roof-Mounted equipment

With the exception of outdoor air intake, and exhaust air hoods, HVAC equipment shall not be mounted on the roof. However, every attempt shall be made to use wall louvers for intake and exhaust air. When exterior ground-mounted equipment is required, decorative screen walls, with access to facilitate the removal of the equipment, shall be designed by the project architect.

#### 2.9.6.14 Maintenance Considerations

Each piece of equipment shall be installed so it can be properly maintained. Clearances must be provided around all equipment to allow it to be serviced, removed, and replaced as required. Convenient access shall be provided in the mechanical room as well as the entire building to all above and below ground utilities, cleanouts, HVAC equipment and systems, and gas fittings.

#### 2.9.6.15 Cathodic Protection

For cathodic protection, reference paragraph: Corrosion Control.

#### 2.9.6.16 Seismic Requirements

All mechanical and electrical equipment shall be seismically protected as required in section Mechanical and Electrical Seismic Protection: of this document.

#### 2.9.6.17 HVAC Control Systems

All control systems shall be direct digital control (DDC). Pneumatic actuators and controls shall only be allowed on large damper and valve actuators located in the mechanical room. The system shall be capable of transmitting through a modem all information/setpoints input or calculated by the DDC controller to the Energy Monitoring and Control System (EMCS). This shall include air terminal unit setpoints, room temperatures, chilled and hot water supply and return temperatures, and operational status of all equipment. There is no requirement to install a modem at this time. An economizer cycle shall be provided for all air handling units, and shall be capable of supplying 100% of the fan air flow. Air flow measuring stations shall be provided in the supply, return, and outside air ducts to properly sequence the amount of return and outside air when the supply fan air flow modulates in response to a static pressure sensor in the supply duct.

#### 2.9.6.18 Noise Criteria

All mechanical equipment and systems shall be selected on the basis of acoustical impact on the building occupants and shall follow noise limitations established by (OSHA). Maximum noise level for general office spaces, shall not exceed NC 30.

#### 2.9.6.19 HVAC System Testing and Balancing

Testing and balancing shall be performed on all air and hydronic systems.

##### 2.9.6.19.1 Qualifications

The contractor shall obtain the services of a qualified testing organization independent of the installing contractor or equipment suppliers for this project. The criteria for determining qualifications shall be membership in the Associated Air Balance Council (AABC) or certification by the National Environmental Balancing Bureau (NEBB). In addition, the testing organization shall submit proof to satisfy the Contracting Officer that the organization meets the technical standards for membership in the AABC. Prior to commencing work, the testing organization shall have been approved by the Contracting Officer to perform the testing and balancing.

#### 2.9.6.19.2 Procedures

Procedures, in general, shall be in accordance with the AABC "National Standards for Field Measurements and Instrumentation-Total System Balance" and NEBB Procedural Standards for Testing-Adjusting-Balancing of Environmental Systems. All system and components there of shall be adjusted to perform as required by the drawings and specifications. Operating tests of heating and cooling coils, fans, chiller, and boilers shall be of not less than four (4) hours duration after stabilized operating conditions have been achieved. Sound level measurements shall be taken at times when the building is unoccupied. Meters shall comply with ANSI 51-11. Readings shall be made for each octave band, and shall be taken not less than 1 m from any surface. The Contracting Officer shall select not less than 10, nor more than 20 rooms for testing. The maximum allowable NC levels are as stated. See paragraph: Noise Criteria.

#### 2.9.6.19.3 Agenda

Contractor shall review the plans and specification prior to the installation of any system and submit a written report to the Contracting Officer indicating deficiencies that would preclude proper balancing. 20 working days prior to start of the testing and balancing, the contractor shall submit an agenda for approval by the Contracting Officer.

#### 2.9.6.19.4 Certified reports

After the field testing is completed, the Contractor shall submit three (3) copies of the certified reports covering air and water system performances. The reports shall be signed by a registered professional engineer (PE) who is versed in the field of air and water balancing and who is not affiliated with any firm involved in the planning or construction of this project.

#### 2.9.6.19.5 Recheck

At the time of the final inspection, the Contractor shall recheck, in the presence of the Contracting Officer, a random selection of data recorded in the certified report. Points for recheck shall be selected by the Contracting Officer.

#### 2.9.6.19.6 Equipment Settings

Following final acceptance of the Certified Report, the contractor

shall permanently mark the settings of all dampers, valves, etc.

#### 2.9.6.20 Training

Contractor shall include a training period for Base maintenance personnel. The training period shall be a minimum of six (6) hours of on-site instructions.

#### 2.9.6.21 Backflow Preventers

For equipment requiring water, see paragraph: Water Meters and Backflow Preventers:

#### 2.9.6.22 Boilers

The boiler capacity shall be based on the ratings shown in HYI-01 or as certified by the American Boiler Manufacturers Association, or American Gas Association. Boilers shall be the natural gas fired type and have the output capacity in kilowatts (kw). Boilers with a capacity less than 85 kw shall have an Annual Fuel Utilization Efficiency of at least 80 percent. Boilers with a capacity of greater than or equal to 85 kw shall have a combustion efficiency of at least 80 percent when fired at the maximum and minimum ratings allowed by the controls. Contractor shall be required to provide all permits required by both state and local agencies for the boiler installation. If required, low NoX burners shall be provided.

##### 2.9.6.22.1 Boiler Accessories and Requirements

Boilers shall be constructed, and equipped in accordance with ASME BPV IV. The boiler shall be furnished complete with the natural gas burning equipment, boiler fittings and trim, automatic controls, forced or induced draft fan, electrical wiring, insulation, piping connections, and protective jacket. The boiler shall be completely assembled and tested at the manufacturer's plant. Boiler auxiliaries including fans, motors, drives, and similar equipment shall be provided with at least 10 percent excess capacity to allow for field variations in settings and to compensate for any unforeseen increases in pressure losses in appurtenant piping and ductwork. However, the boiler safety devices shall not be sized for a 10 percent excess capacity. The boiler and its accessories shall be installed to permit ready accessibility for operation, maintenance, and service. Each boiler shall be either of the firetube, watertube, or cast iron type for water service as specified herein.

##### 2.9.6.22.2 Firetube Boiler

Boiler shall be self-contained, multipass, packaged type, complete with all accessories, mounted on a structural steel base. When the boilers is operating at maximum output, the heat input rates shall not be greater than 21 Kw per square meter of fireside heating surface. The volume heat input rate shall not be less than 2,070 Kw per cubic meter of furnace volume.

##### 2.9.6.22.3 Watertube Boiler

Boiler shall be self-contained, packaged type, complete with all

accessories, mounted on a structural steel base. The heat input rate for finned tube styles shall not be greater than 38 Kw per square meter based on internal heater area. The heat input rate for other boilers shall not be greater than 21 Kw per square meter of fireside heating surface.

#### 2.9.6.22.4 Cast Iron Boiler

Boiler shall be of the rectangular, sectional type, self-contained, packaged type, complete with accessories, mounted on a structural steel base. Cast iron sections shall be free of leaks under all operating conditions. Access shall be provided to permit cleaning of internal tube surfaces.

#### 2.9.6.22.5 Gas Fired Burners and Controls

Burner shall be provided complete with fuel supply system in conformance with the following safety codes or standards: Gas fired units shall conform to UL 795, Gas fired units less than 3,660 kw input shall conform to ANSI Z21.13.

#### 2.9.6.23 Insulation, Heating Ductwork

Mineral fiber shall comply with Fed. Spec. HH-I-558 and cellular glass shall comply with ASTM C 552. Sheet metal supply and return ducts shall be insulated with 50 mm thick mineral fiber, except that return ducts in plenums or conditioned spaces do not need to be insulated. Insulation for ductwork used for both heating and cooling shall conform to the requirements for cooling ductwork. Insulation shall be applied to the outside of the duct.

#### 2.9.6.24 Insulation, Heating Water Pipes

Mineral fiber shall comply with Fed. Spec. HH-I-558 and cellular glass shall comply with ASTM C 552. Heating hot water less than 100 mm in diameter shall be insulated with 50 mm mineral fiber or cellular glass. Hot water pipes 100 mm in diameter or greater shall be insulated with 65 mm thick mineral fiber or cellular glass. All pipe hangers for insulated pipes shall utilizing high-density inserts and shields (or saddles) to protect the pipe insulation.

#### 2.9.6.25 Fans

Fans shall be tested and rated in accordance with AMCA 210. Fans may be connected to the motors either directly or indirectly with V-belt drive. V-belt drives shall be sized for not less than 150 percent of the connected driving capacity. Motor sheaves shall be variable pitch for 11.2 kilowatts and below and fixed pitch as defined by ARI Guideline D. Variable pitch sheaves shall be selected to drive the fan at a speed which will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, a replaceable sheave shall be provided when needed to achieve system air balance. Motors for V-belt drives shall be provided with adjustable rails or bases. Removable metal guards shall be provided for all exposed V-belt drives, and speed-test openings shall be provided at the center of all rotating shafts. Fans shall be provided with personnel screens or guards on both suction and



supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Fan and motor assemblies shall be provided with vibration-isolation supports or mountings. Vibration-isolation units shall be standard products with published loading ratings. Each fan shall be selected to produce the capacity required at the fan static pressure as calculated. Sound power level shall be indicated. The sound power level values shall be obtained in accordance with AMCA 300. Impeller and housing in the air stream of vehicle exhaust and welding exhaust fans shall be coated with neoprene, epoxy, phenolic resins, or other approved material suitable to resist the corrosive gases and temperatures produced.

#### 2.9.6.25.1 Centrifugal Fans

Centrifugal fans shall be fully enclosed, single-width single-inlet, or double-width double-inlet, AMCA Pressure Class I, II, or III as required for the planned system pressure. Impeller wheels shall be rigidly constructed, accurately balanced both statically and dynamically. Fan blades may be forward curved, backward-inclined or airfoil shape in wheel sizes up to 760 mm. Fan blades for wheels over 760 mm in diameter shall be backward-inclined or airfoil shape. Fan wheels over 915 mm in diameter shall have overhung pulleys and a bearing on each side of the wheel. Fan wheels 915 mm or less in diameter may have one or more extra-long bearings between the fan wheel and the drive. Bearings shall be sleeve type, self-aligning and self-oiling with oil reservoirs, or precision self-aligning roller or ball-type with accessible grease fittings or permanently lubricated type. Bearing life shall be L50 rated at not less than 200,000 hrs as defined by AFBMA 9 and AFBMA 11. Fan shafts shall be steel, accurately finished, and shall be provided with key seats and keys for impeller hubs and fan pulleys. Each fan outlet shall be of ample proportions and shall be sized for the attachment of angles and bolts for attaching flexible connections. Motors, unless otherwise indicated, shall not exceed 1800 rpm.

#### 2.9.6.25.2 In-Line Centrifugal Fans

In-line fans shall have centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Fans shall be mounted in a welded tubular casing. Air shall enter and leave the fan axially. Inlets shall be streamlined with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Fan bearings and drive shafts shall be enclosed and isolated from the air stream. Fan bearings shall be sealed against dust and dirt and shall be permanently lubricated, and shall be precision self aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hrs as defined by AFBMA 9 and AFBMA 11.

#### 2.9.6.25.3 Centrifugal Type Power Wall Fans

Fans shall be V-belt driven centrifugal type with backward inclined, non-overloading wheel. Motor housing shall be removable and weatherproof. Unit housing shall be designed for sealing to the building surface and for discharging any condensate accumulation away from building surface. Housing shall be constructed of heavy gauge aluminum. Unit shall be fitted with an aluminum or plated steel wire

discharge bird screen, manufacturer's standard gravity damper, an airtight and liquid-tight metallic wall sleeve. Motor enclosure shall be totally enclosed fan cooled type. Lubricated bearings shall be provided.

#### 2.9.6.25.4 Cabinet Exhaust Fans

Suspended cabinet-type ceiling exhaust fans shall be centrifugal type, direct-driven. Fans shall have acoustically insulated housing. Integral backdraft damper shall be chatter-proof. The integral face grille shall be of egg-crate design or louver design. Fan motors shall be mounted on vibration isolators. Unit shall be provided with mounting flange for hanging unit from above. Fans shall be UL listed.

#### 2.9.6.26 Air Filters

Air filters shall be listed according to requirements of UL 900. Each set of filters shall have a magnahelic type pressure gage.

##### 2.9.6.26.1 Extended Surface Pleated Panel Filter

Pre-filters shall be 50 mm depth, sectional, disposable type of the size indicated and shall have an average efficiency of 25 to 30 percent when tested in accordance with ASHRAE 52. Initial resistance at 2.5 meters per second will not exceed 90.0 kPa. Filters shall be UL Class 2. Media shall be nonwoven cotton and synthetic fiber mat. A wire support grid bonded to the media shall be attached to a moisture resistant fiberboard frame. All four edges of the filter media shall be bonded to the inside of the frame to prevent air bypass and increase rigidity.

##### 2.9.6.26.2. Extended Surface Non-Supported Pocket Filters

Filters shall be approximately 760 mm in depth, sectional, replaceable dry media type of the size indicated and shall have an average efficiency of 80 to 85 percent when tested according to ASHRAE 52.1. Initial resistance at 2.5 meters per second air velocity shall not exceed 112.6 kPa. Filters shall be UL Class 1. Media shall be fibrous glass, supported in the air stream by a wire or non-woven synthetic backing and secured to a galvanized steel metal header. Pockets shall not sag or flap at anticipated air flows. Each filter shall be installed with an extended surface pleated panel filter as a prefilter in a factory preassembled, side access housing or a factory-made sectional frame bank.

##### 2.9.6.26.3 Cooling

The aircraft bays cooling and humidification shall be provided by an evaporative cooling system.

#### 2.9.6.27 Energy Management Control System (EMCS) Interface

The control system shall be capable of communicating all data to a remote integrated DDC processor through a single shielded cable. The data shall include as a minimum all system operating conditions, and safety shutdown conditions.

#### 2.9.6.28 Commissioning

Shall be included in the testing and the training. The training shall consist of 4 hours for each piece of system equipment.

#### 2.9.7 Plumbing

##### 2.9.7.1 General

Plumbing systems shall be installed in accordance with the latest edition of the National Standard Plumbing Code (NAPHCC). Inspection and testing of the plumbing system shall be performed as prescribed in the National Standard Plumbing Code. Additional referenced standards shall include the Uniform Plumbing Code, Americans With Disabilities Act, Uniform Federal Accessibility Standards, applicable Occupational Safety and Health Act (OSHA) regulations, and the Mechanical and Electrical Seismic Protection part of this document. The minimum rough in size for waste lines is 50mm, except for water closets, where the minimum size is 100mm. Acceptable materials for service connections be ductile iron, type K copper, and PVC plastic pipe. Acceptable materials for interior piping include type L copper. A back-flow preventer will be installed on all sprinkling systems, and before any industrial process plumbing; except for non-potable water systems. Water lines shall be inside the buildings thermal envelope. Pipes, and drinking fountains shall not be placed in or on outside walls to prevent freezing. Avoid placement near outside air vent opening.

##### 2.9.7.2. Materials and Equipment

Materials and equipment shall be standard catalog products of manufacturers regularly engaged in production of such materials. All selected equipment shall be manufacturer's latest standard model.

##### 2.9.7.3 Seismic Requirements

All mechanical and electrical equipment shall be seismically protected as required in section Mechanical and Electrical Seismic Protection: of this document.

##### 2.9.7.4 Submittals

Submittals shall be provided by the Contractor to the Contracting Officer for approval in accordance with Specification Section: 01330 SUBMITTAL PROCEDURES which is included in this document in the Technical Specifications of the Statement of Work.

##### 2.9.7.4.1 Calculations, Drawings, and Specifications

Installation of the plumbing equipment shall not begin until such time that all the calculations, drawings, and specifications have been submitted and approved as indicated above.

##### 2.9.7.4.2 Operation & Maintenance (O&M) Manuals

Six (6) complete copies of an O&M manuals in bound 216 mm by 279 mm booklets shall include a brief description of all equipment and their basic operating features, piping and equipment layouts, the

manufacturer's name, model number, service manual, parts list and simplified wiring and control diagrams of the systems as installed. In addition, the booklets shall list step-by-step procedures required for system startup, operation, shutdown, routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide.

#### 2.9.7.5 Plumbing Fixtures and Equipment

To minimize future maintenance efforts and associated costs, reference paragraph: Maintenance Considerations.

##### 2.9.7.5.1 Plumbing Fixtures, General

Fixtures shall be water conservation type, in accordance with NAPHCC-01. Fixtures shall be provided complete with fittings. With the exception of the Waterless Urinals, all fixtures, fittings, and trim in a project shall be from the same manufacturer and shall have the same finish. Faucets shall be equipped with high efficiency faucet aerators. All faucets, faucet handles, and miscellaneous trim shall be of metal construction with a polished chrome finish. Plumbing fixture requirements by number of occupants are found in AFMAN 32-1070, Chapter 4.

##### 2.9.7.5.2 Faucets

Faucet shall be center set single-lever type with seals and seats combined in one replaceable cartridge sized to be interchangeable among similar fixtures such as lavatories or having replaceable seals and seats removable either as a seat insert or as a part of a replaceable valve unit. Water flow for manually operated faucets shall not exceed .16 liters/second at 549 Kpa. Water flow for faucets with automatic flushing systems will be no more than 1 liter per cycle from the any faucet.

##### 2.9.7.5.3 Countertop Lavatories

Lavatories shall be manufacturers standard sink depth, enameled cast iron or vitreous china, oval type, as indicated on the drawings, and shall comply with ASME A112.19.1M or ASME A112.19.2M. Strainer shall be copper alloy or stainless steel.

##### 2.9.7.5.4 Water Closets

Water closets shall be the floor-mounted elongated vitreous china bowl type with top supply spud and white closed-front seat and cover, and comply with ASME A112.19.2M. Flushometer valve shall be large diaphragm type with non-hold open feature, backcheck angle control stop, and vacuum breaker. The minimum upper chamber inside diameter shall be not less than 65 mm at the point where the diaphragm is sealed between the upper and lower chambers. The maximum water use per flush is 6 liters. Flush valve shall be solenoid-activated with electrical-operated light beam sensor to energize solenoid.

##### 2.9.7.5.5 Urinals

Urinals, Wall hanging, with integral trap and extended shields, ASME A112.19.2M (washout). Top supply connection, back outlet. Flushometer Valve shall have a maximum water use of 3.8 liters per flush.

#### 2.9.7.5.6 Service Sinks

Service sinks shall be provided for the janitor closets. Sinks shall be enameled cast iron, copper alloy, or stainless steel, and shall comply with ASME A112.19.1M or 3M, as applicable. Faucets shall have replaceable seat, the stem shall rotate onto the seat, a wall brace, and a backflow preventer which may be an add on item. Faucet handles shall be the lever-type. Strainers shall have internal threads. Spouts shall be externally threaded for hose connection and swing.

#### 2.9.7.5.7 Floor Drains

Floor drains shall be provided in the mechanical room(s) and in areas with condensate producing equipment, and shall comply with ASME A112.21.1M. Floor drains shall be provided in restrooms with 3 or more water closets. Floor drains shall be cast iron with integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel bronze, or nickel brass strainer. Trap primers shall be provided where required by the NAPHCC.

#### 2.9.7.5.8 Floor Sinks

Provide a floor sink in the new mechanical rooms. All cooling coil condensate drains shall be piped to the floor sink. Sink shall be square with 300 mm nominal overall width and 250 mm nominal depth and shall have a acid resistant enamel finish with cast iron body. Trap primers shall be provided where required by the NAPHCC.

#### 2.9.7.5.9 Electric Water Coolers

Electric water coolers shall be self contained, use one of the fluorocarbon gases conforming to ARI 700 and ASHRAE 34 which has an ozone depletion potential of .05 or less. Min capacity shall be 30.2 liters per hour at 10 Deg C with an inlet water temperature of 27 Deg C, while residing in a room environment of 32 Deg C. Unit shall have self closing valves with automatic stream regulators, flow control capability, push button actuated. Exposed surfaces of stainless steel shall have a no. 4 general polish. Spouts shall provide a flow of water at least 100 mm high so as to allow the insertion of a cup or glass under the flow of water.

#### 2.9.7.6 Water Heaters

The building heating and domestic hot water systems shall be separate. All water heaters shall be the self-contained type with, as a minimum, storage tank, burner, controls, and safety features. The water heater shall be located in the Mechanical room, and shall serve all new fixtures installed under this contract.

##### 2.9.7.6.1 Capacity

The water heating system shall be sized in accordance with the Hot Water Demand Per Fixture method as defined in the latest edition of ASHRAE HVAC Applications Handbook. For hot water demand and storage capacity calculations, assume the type of building is a "School".

#### 2.9.7.6.2 Type

The water heater shall be a gas-fired automatic storage type, and shall comply with the requirements of ASHRAE 90A. The storage tanks shall be either the vertical or horizontal type and be glass lined. The heater shall be complete with a control system and shall have ASME rated pressure and temperature relief valves. Gas fired heaters shall conform to ANSI Z21.10.1 when input is 75,000 btuh or less and ANSI Z21.10.3 for heaters with input greater than 75,000 btuh.

#### 2.9.7.6.3 Hot Water Circulating Pumps

Circulating pumps shall be electrically driven, single stage, centrifugal, mechanical seals, and suitable for the intended service. The pump shall recirculate water from remote fixtures back through the water heater. Pump shall be controlled by a sensor on the recirculation line, set for approximately 41 Deg C.

#### 2.9.7.6.4 Thermostatic Mixing Valves

Thermostatic mixing valve(s) shall be located in the mechanical room next to the water heater(s) and shall be designed and manufactured specifically for domestic hot water temperature control. The thermostatic mixing valve(s) shall be capable of maintaining a constant 43 degrees C (plus or minus 2 degrees C) water temperature under minimum and maximum hot water demands for the lavatories. If required, each thermostatic mixing valve shall be equipped with a separate low-demand valve and a high-demand valve to ensure water temperature reliability at different flow rates.

#### 2.9.7.7 Water Meters and Backflow Preventers

Provide a water meter, reduced pressure backflow preventer assemblies, and drain valves on the domestic cold water lines serving the facility. Domestic cold water shall be taken from an exterior water main. The backflow preventer shall be approved by AWWA C506. A separate reduced pressure backflow preventer shall be installed on the building potable water system for makeup water to equipment such as boilers and chillers which use chemically treated water. Discharge water from the backflow preventers shall be piped to a floor sink or drain. The fire sprinkler system shall be isolated by a double check backflow preventer. See paragraph: Fire Riser and Fire Department Connection.

#### 2.9.7.8 Gas Regulator/Meter Assembly

Regulator/meter assembly shall be sized for the building gas requirements. The regulator/meter shall be located outside next to the mechanical room. The assembly shall be provided with plug cocks on the inlet and outlet with provisions to remove the meter for service with minimal downtime. A building shut off valve and a seismic valve on the gas line serving the facility shall be provided.

#### 2.9.7.9 Domestic Water Piping

All domestic water piping shall be concealed. Stops will be provided on water supply lines to all plumbing fixtures except showers. All above grade water piping shall be installed inside the building thermal

envelope.

#### 2.9.7.9.1 Pipe

Copper joints shall be soldered with wire solder of 95 percent tin and 5 percent antimony. Di-electric isolation shall be provided to water heaters and between all equipment with dissimilar metals.

#### 2.9.7.9.2 Above Ground Water Piping

All above ground piping shall be Type L hard-drawn copper. Fittings for hard-drawn copper shall conform to ANSI B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

#### 2.9.7.9.3 Below Ground Water Piping

All underground piping shall be seamless copper water tube, ASTM B 88, type K, with brazed joints only of type K soft temper without joints. Under slab supply piping shall be limited to building service entrance only. Protective Coating. Protective coatings will be applied to the exterior surface of underground ferrous pipes.

#### 2.9.7.9.4 Wall Faucets

Provide wall faucets on the exterior walls of the building at 30 meter intervals. In addition, wall faucets shall be installed in the mechanical rooms. All wall faucets shall have an integral vacuum breaker backflow preventer, detachable kit handle, and 20 mm hose connection. wall faucets on the outside wall of the building shall be recessed into the wall with a nickel-brass or nickel-bronze wall plate. Faucets shall be a freeze protection design.

#### 2.9.7.10 Natural Gas Piping

Installation of the gas system shall be in accordance with NFPA 54, the National Fuel Gas Code, UL-06, the Gas and Oil Equipment Directory, and all local/seismic codes. All above ground gas piping shall be schedule 40 black steel. All underground shall be Polyethylene with tracer wire. Polyethylene valves will be used. All risers must be anodeless. Tracer wire will be provided on all lines and will be tied off at all risers. The use of semirigid tubing and flexible connectors is prohibited except for final connections to gas equipment and appliances. Buried pipe under the building shall not be permitted.

##### 2.9.7.10.1 Gas Service

The available gas line pressure is approximately 82.7 kPa (12 PSIG).

##### 2.9.7.10.2. Gas Connections

Final connections for gas equipment and appliances shall be made using flexible connectors conforming to ANSI Z21.45. Flexible connectors shall be all metal construction manufactured for gas equipment and appliances and not more than 1 m long. Accessible gas shutoff valves and couplings shall be provided for each gas equipment and appliance connection.

#### 2.9.7.11 Insulation

All pipe hangers for insulated pipes shall utilize high-density inserts and shields (or saddles) to protect the pipe insulation.

##### 2.9.7.11.1 Domestic Water Piping

Domestic hot water pipes shall be insulated as per paragraph: Insulation, Heating Water Pipes, except as follows: pipes 50 mm or smaller shall be insulated with 25 mm thick mineral fiber or 40 mm thick cellular glass and pipes 65 mm or larger shall be insulated with 40 mm thick mineral fiber or 65 mm thick cellular glass. Domestic cold water piping shall be insulated with a vapor barrier as per paragraph: Insulation, Chilled Water Pipes, except as follows: pipes 125 mm or smaller shall be insulated with 15 mm thick mineral fiber or 25 mm thick cellular glass and pipes 125 mm and larger shall be insulated with 25 mm thick mineral fiber or 40 mm thick cellular glass. Where the specified insulation thickness for domestic water pipes is too large for concealment in chase walls, the thickness may be reduced. Where domestic pipe runouts to fixtures occur, the insulation may be omitted. Condensate drain piping shall be insulated as per paragraph: Condensate Drain Piping and Insulation.

#### 2.9.7.12 Sanitary Piping

All sanitary piping shall be concealed. Each fixture and piece of equipment, except water closets and urinals, requiring connection to the drainage system shall be provided with a trap.

##### 2.9.7.12.1 Drain, Waste, and Vent Piping

Drain, waste, and vent piping shall be either cast iron (no hub or hub type) or ABS in accordance with ASTM D 2661 (no cellular core).

##### 2.9.7.12.2 Waste Traps

Deep seal trapped drain shall be provided on all cooling coil condensate drains. Traps for lavatories shall be chromium-plated, adjustable-bent tube, 20-gauge brass, or ABS in accordance with ASTM D 2661 (no cellular core).

#### 2.9.7.13 Corrosion Control

Cathodic protection shall be provided on all buried or submerged ferrous piping (including cast iron), tanks, and related facilities. Under no circumstances shall underground facilities be installed without cathodic protection.

##### 2.9.7.13.1 Design

All cathodic protection shall be designed by an engineer accredited by the National Association for Corrosion Engineers (NACE). The Design shall be based upon specific field tests made at the construction site.

##### 2.9.7.13.2 Cast Iron Pipe



All buried or submerged cast iron pipe joints shall be bonded with No.2 AWG insulated wire. Thermit wire connections shall be coated.

## 2.9.8 Fire Protection

### 2.9.8.1 General

The entire facility, excluding the hanger bays, shall be protected with wet pipe sprinkler systems. The hanger bays shall be protected with both wet pipe and underwing foam-water sprinkler systems. All systems shall be installed in accordance with NFPA-13. The design of the sprinkler systems shall comply with MIL-HDBK-1008C (Fire Protection for Facilities Engineering, design, and Construction). The design of the sprinkler systems for the hanger bays shall be in accordance with both MIL-HDBK-1008C and Engineering Technical Letter (ETL) 98-7 (Fire Protection Engineering Criteria-New Aircraft Facilities). All systems shall be hydraulically calculated.

### 2.9.8.2 Materials and Equipment

Materials and equipment shall be standard catalog products of manufacturers regularly engaged in production of such materials. All selected equipment shall be manufacturer's latest standard model. Materials and equipment shall have been tested by Underwriters Laboratories (UL) and listed un UL-04 or approved by Factory Mutual (FM) and listed in FM P7825. All aboveground sprinkler piping shall be Sch 40 black steel pipe, Sch 40 galvanized steel pipe, or Type 'K' copper tubing. All control valves (PIV's) require a tamper switch. Each riser will have a separate flow switch for each floor level and each riser. Buried fire protection water service lines shall be buried at least 5 1/2-feet below grade. Fire sprinkler piping will be located in a heated area or in an insulated attic where temperatures are assumed not to drop below 40 degrees F. HALON type fire suppression system shall not be used. Use CO<sub>2</sub> system where needed.

### 2.9.8.3 Submittals

Submittals shall be provided by the Contractor to the Contracting Officer for approval in accordance with Specification Section: 01330 SUBMITTAL PROCEDURES which is included in this document in the Technical Specifications of the Statement of Work.

#### 2.9.8.3.1 Designer Qualifications

All hydraulic calculations and drawings showing the layout of the sprinkler system shall be done by a registered Fire Protection Engineer. Written proof of registration and experience shall be submitted to the Contracting Officer for approval.

#### 2.9.8.3.2 Calculations, Drawings, and Specifications

Installation of fire protection equipment shall not begin until such time that the calculations, drawings, and specifications have been reviewed and approved as indicated above.

#### 2.9.8.3.3 Operation & Maintenance (O&M) Manuals

Six (6) complete copies of an O&M manuals in bound 216 mm by 279 mm booklets shall include a brief description of all equipment and their basic operating features, piping and equipment layouts, the manufacturer's name, model number, service manual, parts list and simplified wiring and control diagrams of the systems as installed. In addition, the booklets shall list step-by-step procedures required for system startup, operation, shutdown, routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide.

#### 2.9.8.4 Occupancy Ratings:

The occupancy ratings for typical rooms shall be as indicated in the table below. Rooms not listed below shall be based on Mil-HDBK-1008C. Sprinkler densities apply to a remote area of 280 Sq. Meters. The Aircraft service bays shall be based on ETL 98-7.

<u>Area:</u>	<u>Occupancy:</u>	<u>Density:</u> (l/min/sq.m)
Storage rooms	Ord. Haz. Group 2	8.15
Elev equip Room	Ord. Haz. Group 2	8.15
Mechanical Rooms	Ord. Haz. Group 2	8.15
Com Rooms	Ord. Haz. Group 1	6.11
Electrical Rooms	Ord. Haz. Group 1	6.11
Janitors Room	Ord. Haz. Group 1	6.11
Admin, Offices, conference Room, Corridors, Classrooms, Labs Stairwells, etc.)	Light Haz.	4.07
Aircraft Service Bays	N/A See ETL 98-7	8.15 overhead + 4.07 foam water underwing.

#### 2.9.8.5 Hydraulic Calculations:

Hydraulic calculations shall be based on a static pressure of 8.48 bars(123 PSIG) and a residual pressure of 6.9 bars at a flow of 9450 liters/min (2500 GPM). The pressures and flows shall be assumed to exist at the point of connection of the new water line to the existing main. The Contractor shall minimize the pressure drop from the Base water main point-of-connection, by doing things like increasing line sizes, reducing sprinkler head spacing, and providing low pressure drop backflow preventers, in order to meet the specified densities/area requirements with the available water supply. In all cases, sprinkler and hose stream demands(except for the aircraft service bays, which don't require a hose stream) shall be assumed to take place simultaneously. Calculations shall be based on the hydraulically most remote 280 square Meters (except for the aircraft service bays), with a hose stream flow of 946 liters/minute (500 GPM). The hose stream flow shall be assumed to exist at the new hydrant. The contractor shall confirm the water supply data specified herein by performing his own fire flow test. This shall be done prior to completing the hydraulic calculations

#### 2.9.8.6 Fire Riser and Fire Department Connection (Excluding Systems in the Aircraft Service Bays)

The riser(s) assembly shall be installed above grade in the mechanical room and shall be a minimum of 150 mm in diameter. Each riser(s) shall comprise of a pressure gauge, O.S.&Y. supervised control valve, second pressure gauge, third pressure gauge, main sprinkler system drain, and water flow indicator. A common 100 mm check valve connected to a 65 mm x 65 mm x 100 mm fire department connection shall serve all the risers in mech. room. Also, an FM approved reduced pressure backflow preventer assembly shall separate the riser assemblies from the potable water main. Flow indicator shall be connected to a local-alarm circuit, transmitted-alarm circuit, and power-supply circuit. 65 mm x 65 mm x 100 mm fire department connection shall be installed outside the building.

#### 2.9.8.7 Local Fire Alarm (Excluding systems in the Aircraft Service Bays)

Building exterior fire alarm indication shall be by an electrically operated bell located on an outside wall adjacent to the sprinkler riser. The transmitted alarm signal to the main fire station shall be under the electrical portion of this contract.

#### 2.9.8.8 Sprinkler Heads (Excluding Systems in the Aircraft Service Bays)

Sprinkler heads in T-bar ceilings, unless indicated otherwise, shall be centered on the ceiling tiles in one direction. The sprinkler temperature ratings shall be suitable for the hazard being protected.

##### 2.9.8.8.1 Areas With Finished Ceilings (Excluding systems in the Aircraft Service Bays)

Sprinkler heads in areas with suspended or gypsum board ceilings shall be the concealed type. Sprinkler heads in light hazard areas shall be quick response type.

##### 2.9.8.8.2 Exterior Areas and Areas Without Finished Ceilings (Excluding systems in the Aircraft Service Bays)

Areas without suspended or gypsum board ceilings such as mechanical rooms, electrical rooms, com rooms, etc. shall be protected by exposed upright type sprinkler heads. Sprinklers shall be the quick response type.

##### 2.9.8.8.3 Covers And Escutcheons (Excluding Systems in the Aircraft Service Bays)

All exposed and fully recessed type sprinkler heads shall be polished chrome with white escutcheon rings.

#### 2.9.8.9 Aircraft Service Bays

The aircraft service bays shall be protected in accordance with ETL 98-7, Fire Protection Engineering Criteria-New Facilities. The aircraft shall be considered to be fueled. The bays will be protected with both underwing and overhead systems. The overhead system shall be a wet pipe

system, designed to discharge 8.15 L/Min/ Sq. M over 465 sq. meters(5000 SF). (Note that this differs from ETL 98-7, para A3.1.1.2, which requires 8.15 L/Min Sq. M over 15,000 SF. The Air Force has recently reduced the overhead design area for hangers with underwing foam/water protection). The underwing suppression system shall be a foam-water nozzle system designed to provide 4.07 L/Min/SM over the aircraft service area. The peak fire flow is the sum of all the underwing nozzles and the overhead system(s) discharging simultaneously. A separate hose stream flow is not required. Some of the important features of the system are indicated below.

#### 2.9.8.9.1 Underwing Foam-Water Nozzles

The underwing nozzles shall be fixed, in accordance with ETL 98-7, para A3.4.3.3.6. Oscillating nozzles may only be used if fixed nozzles cannot provide the required coverage. Nozzles shall be located a minimum of 3 meters from the walls of the hanger. The maximum flow rate from any one nozzle shall be 1,900 Liters/min ~~(from 132 Liters/min)~~. Nozzles shall deliver a mixture of 3% Aqueous Film Forming Foam (AFFF).

#### 2.9.8.9.2 Overhead system

The overhead system shall be water only, designed to discharge 8.15 L/Min/SM over 465 Sq. Meter. The maximum area of coverage for a single overhead system is 1400 Sq. Meters (ETL 98-7, para A3.2.3). Sprinkler heads shall be upright quick response type, with a temperature rating of 79.4 Deg C (175 Deg F).

#### 2.9.8.9.3 Foam Systems

Aqueous Film forming foam (AFFF) shall comply with Mil-F-24385F(ETL 98-7, para 3.6). High expansion foam shall not be used. Provide a sufficient supply of foam concentrate sized for a single 10 minute application of foam, based on the actual system flow in the hydraulically most demanding area. In-line balanced-pressure (ILBP) proportioners shall be used on pumped concentrate systems. ILBP's shall not be used on bladder tank systems. Proportioners shall be limited to 150mm or less. Foam concentrate pipe shall be stainless steel. A separate foam system shall be provided for each hanger.

A. Foam system Controls: A foam system control panel and detection system shall be provided in each hanger, and shall be installed in accordance with NFPA 72 (ETL 98-7, para 3.7). The foam system control panel shall control all suppression and detection systems in the hanger, and shall be interfaced with the building fire alarm panel. Low level optical fire detectors shall be provided and shall provide alarm notification only. Manual foam discharge stations shall be provided at the exits from the hanger to activate the nozzle systems.

#### 2.9.8.9.4 Fire Risers

Fire risers shall be provided as indicated above in paragraph 2.9.3.6, except that a fire department connection is not required.

#### 2.9.8.9.5 Backflow Prevention

A reduced pressure backflow preventer shall be separate the foam-water fire protection systems from the potable water system.

#### 2.9.8.9.5 AFFF Containmentment

AFFF release shall be allowed to flow into existing base storm drain. Containmentment of AFFF shall not be required.

### 2.9.9 Mechanical and Electrical Seismic Protection

#### 2.9.9.1 General

The Contractor shall design the bracing in accordance with TI 809-04 and additional data furnished by the Contracting Officer. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads. For the final design submittal, the contractor shall submit design calculations and details of seismic supports for mechanical equipment certified by a licensed structural engineer.

#### 2.9.9.2 Mechanical/Electrical Equipment

The designer shall ensure that, from the examples below as a minimum, all electrical and mechanical items and systems to be braced.

##### 2.9.9.2.1 Example Items

Mechanical/electrical equipment shall include, but not be limited to, the following items: Boilers, Water Heaters, Water and Gas Piping, Expansion and Air Separator Tanks, Water Chiller Units, Control Panels, Air Handling Units, Air Terminal Units, Fan-Coils, Pumps with Motors, Light Fixtures, Motor Control Centers, Transformers, Switchboards (Floor Mounted), Suspended Ceiling Assemblies, Ducts, Unit Heaters, Exhaust Fans.

##### 2.9.9.2.2 Example Systems

Mechanical/electrical systems shall include, but not be limited to, the following items: All Piping Inside the Building, Chilled Water Systems Outside of Buildings, All Water Supply Systems, Sanitary Sewer Systems, Chilled Water Piping Outside the Building, All Cable Trays Inside the Building.

#### 2.9.9.3 Equipment Items and Systems

The bracing for the following mechanical/electrical equipment items and systems shall be developed by the Contractor in accordance with the requirements of this document

##### 2.9.9.3.1 Exclusion

Seismic protection of piping for fire protection systems shall be installed as specified in NFPA. Seismic restraints may be omitted from the following installations: Gas piping less than 25 mm inside diameter, Piping in boiler and mechanical equipment rooms less than 32 mm inside diameter, All other piping less than 38 mm inside diameter, Electrical conduit less than 64 mm inside diameter, Rectangular air

handling ducts less than 0.56, Round air handling ducts less than 711 mm in diameter, Piping suspended by individual hangers 300 mm or less in length from the top of pipe to the bottom of the supporting structural member where the hanger is attached, except as noted, and Ducts suspended by hangers 300 mm or less in length from the top of the duct to the bottom of the supporting structural member, except as noted. Note: All hangers shall meet the length requirements. If the length requirement is exceeded by one hanger in the run, the entire run shall be braced.

#### 2.9.9.3.2 All Other Interior Piping, Conduit, and Ducts

Piping, conduit, and ducts not covered by paragraphs Exclusion or Pipes and Ducts Requiring No special Seismic Restraints shall be seismically protected in accordance with the provisions herein.

#### 2.9.9.4 Submittals

Submittals shall be provided by the Contractor to the Contracting Officer for approval in accordance with Specification Section: 01330 SUBMITTAL PROCEDURES which is included in this document in the Technical Specifications of the Statement of Work.

##### 2.9.9.4.1 Calculations and Drawings

All calculations and drawings shall be stamped by a registered structural engineer. Calculations shall verify the capability of structural members to which bracing is attached for carrying the load from the brace. Detail drawings shall include catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. shall be complete in detail, shall indicate thickness, type, grade, class of metal, and dimensions, and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

#### 2.9.9.5 Operation & Maintenance (O&M) Manuals

Six (6) complete copies of an O&M manuals in bound 216 mm by 279 mm booklets shall include a brief description of all equipment and their basic operating features, piping and equipment layouts, the manufacturer's name, model number, service manual, parts list and simplified wiring and control diagrams of the systems as installed. In addition, the booklets shall list step-by-step procedures required for system startup, operation, shutdown, routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide.

#### 2.9.9.6 Materials and Equipment

##### 2.9.9.6.1 Flexible Coupling

Flexible couplings shall have same pressure and temperature ratings as adjoining pipe.

- A. Flexible Mechanical Couplings: Mechanical couplings for steel or cast iron pipe shall be of the sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movement caused by expansion,

contraction, slight settling or shifting of the ground, minor variations in trench gradients, and traffic vibrations. Where permitted in other parts of this document, joints utilizing split-half couplings with grooved or shouldered pipe ends may be used.

- B. Sleeve-type Couplings: Sleeve-type couplings shall be used for joining plain-end pipe sections. The coupling shall consist of one steel middle ring, two steel followers, two gaskets, and necessary steel bolts and nuts to compress the gaskets. Underground bolts shall be the high-strength type.

#### 2.9.9.6.2 Lighting Fixtures

Fixture supports shall be malleable iron. Lighting fixtures and supports shall conform to applicable UL requirements. See Electrical.

#### 2.9.9.7 Execution

##### 2.9.9.7.1 Bracing and Coupling

Bracing and coupling provisions of this paragraph apply to all piping within a 1.5 m line around outside of building unless buried in the ground. Piping grouped for support on trapeze-type hangers shall be braced at the same intervals as determined by the smallest diameter pipe of the group. No trapeze-type hanger shall be secured with less than two 13 mm bolts. Bracing rigidly attached to pipe flanges, or similar, shall not be used where it would interfere with thermal expansion of piping.

##### 2.9.9.7.2. Building Drift

Sway braces for a run shall not be attached to two dissimilar structural elements of a building that may respond differentially during an earthquake unless a flexible joint is provided. Joints capable of accommodating seismic displacements shall be provided where pipes pass through a building seismic or expansion joint, or where rigidly supported pipes connect to equipment with vibration isolators. For threaded piping, swing joints shall be provided. For piping with manufactured ball joints, the seismic drift shall be 0.005 meters per meter of height above the base where the seismic separation occurs; this drift value shall be used in place of the expansion given in the manufacturer's selection table.

##### 2.9.9.7.3 Flexible Couplings or Joints:

- A. Building Piping: Flexible couplings or joints in building piping shall be provided at bottom of all pipe risers larger than 90 mm in diameter. Flexible couplings or joints shall be braced laterally without interfering with the action of the flexible coupling or joint. Cast iron waste and vent piping need only comply with these provisions when caulked joints are used. Flexible bell and spigot pipe joints using rubber gaskets or no-hub fittings may be used at each branch adjacent to tees and elbows for underground waste piping inside of building to comply with these requirements.

- B. Pipe Sleeves: Pipe sleeves in interior non-fire rated walls shall be sized to provide clearances that will permit differential movement of piping without the piping striking the pipe sleeve.
- C. Spreaders: Spreaders shall be provided between adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 100 mm apart. Spreaders shall be applied at same interval as sway braces at an equal distance between the sway braces. If rack type hangers are used where the pipes are restrained from contact by mounting to the rack, spreaders are not required for pipes mounted in the rack. Spreaders shall be applied to surface of bare pipe and over insulation on insulated pipes utilizing high-density inserts and pipe protection shields.
- D. Anchor bolts: It will be the Contractor's responsibility to design the support and anchorage for the equipment in accordance with the specified requirements. The Contractor will ensure that foundations and anchor bolts for pad-mounted or floor-mounted equipment are detailed and designed in accordance with this document.

Cast-In-Place: Floor or pad mounted equipment shall use cast-in-place anchor bolts, except as specified below. Anchor bolts shall conform to the following tabulation for the various equipment weights or the manufacturer's installation recommendations, whichever is the most stringent. Anchor bolts that exceed the normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

Minimum Bolt Sizes for Cast-In-Place Anchor Bolts: Maximum Equipment Weight/Minimum Bolt Sizes are as follows:

Maximum Equipment Weight (Kg)	Minimum Bolt Sizes (mm) *
Up to 13,500	13
13,501-22,500	19
over 22,500	25

\*Based on four bolts per item, a minimum embedment of 12 bolt diameters, a minimum bolt spacing of 16 bolt diameters and a minimum edge distance of 12 bolt diameters. Equivalent total cross-sectional area shall be used when more than four bolts per item are provided. Anchor bolts shall conform to ASTM A 307. Anchor bolts shall have an embedded straight length equal to at least 12 times nominal diameter of the bolt.

Expansion or Chemically Bonded Anchors: Expansion or chemically bonded anchors shall not be used unless test data has been provided to verify the adequacy of the specific anchor and application. The expansion anchor size shall be not less than that required for cast-in-place anchor bolts. Expansion and chemically bonded anchors shall be installed in accordance with the manufacturer's recommendations. The allowable forces shall be adjusted for the spacing between anchor bolts and the distance between the anchor bolt and the nearest edge, as specified by the



manufacturer.

Anchor Bolt Testing: Expansion or chemically bonded anchors shall not be used unless test data has been provided to verify the adequacy of the specific anchor and application. The expansion anchor size shall be not less than that required in paragraph Cast-In-Place. Expansion and chemically bonded anchors shall be installed in accordance with the manufacturer's recommendations. The allowable forces shall be adjusted for the spacing between anchor bolts and the distance between the anchor bolt and the nearest edge, as specified by the manufacturer. Torque wrench testing shall be done on not less than 50 percent of the total installed expansion anchors and at least one anchor for every piece of equipment containing more than two anchors. The test torque shall equal the minimum required installation torque as required by the bolt manufacturer. Torque wrenches shall be calibrated at the beginning of each day the torque tests are performed. Torque wrenches shall be recalibrated for each bolt diameter whenever tests are run on bolts of various diameters. The applied torque shall be between 20 and 100 percent of wrench capacity. The test torque shall be reached within one half turn of the nut, except for 9 mm sleeve anchors which shall reach their torque by one quarter turn of the nut. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified torque; and if the anchor still fails the test it shall be replaced again.

#### 2.9.9.7.4 Resilient Vibration Isolation Devices

Selection of anchor bolts for vibration isolation devices and/or snubbers for equipment base and foundations shall follow the same procedure as in paragraph Cast-In-Place except that an equipment weight equal to five times the actual equipment weight shall be used

#### 2.9.9.7.5 Sway Bracing for Piping

Sway braces shall be provided to prevent movement of the pipes under seismic loading. Braces shall be provided in both the longitudinal and transverse directions, relative to the axis of the pipe. The bracing shall not interfere with thermal expansion requirements for the pipes as described in other parts of this document.

- A. Traverse Sway Bracing: Transverse sway bracing for steel and copper pipe shall be provided at intervals not to exceed those given in the tabulation below. All runs shall have a minimum of two transverse braces. Transverse sway bracing for pipes of materials other than steel and copper shall be provided at intervals not to exceed the hanger spacing as specified by the manufacturer.

Pipe Diameter	Std. Wgt. Steel		Ex.
	Strong Steel	Copper Tube	
		Pipe - 40S	
		Pipe - 80S	
		Type L	

(mm)	*L (m)	** F (kN)	*L (m)	**F (kN)	*L (m)
	**F (kN)				
25				6.7	
			0.30		
			6.7	0.4	
			3.4	0.08	
40				7.6	
			0.60		
			7.9	0.8	
			3.7	0.16	
50				8.8	
			1.0		
			9.1	1.3	
			4.3	0.30	
65				9.8	
			1.7		
			10.0	2.1	
			4.8	0.50	
80				10.4	
			2.5		
			10.7	3.2	
			5.2	0.70	
90				11.0	
			3.3		
			11.6	4.1	
			5.5	1.0	
100				11.9	
			4.3		
			12.2	5.3	
			5.8	1.3	
125				12.5	
			6.4		
			13.4	8.5	
			6.1	2.1	
150			13.7	9.4	
		14.0	12.2		
		6.7	3.3		
200				14.9	
			16.6		
			16.5	22.9	
			7.9	6.9	
250				16.5	
			27.1		
			18.0	34.1	
			8.5	11.7	
300				17.7	
			38.1		
			18.6	46.0	
			9.4	17.6	

\*L = Maximum span between lateral supports. \*\*F = Horizontal force on the brace  
 NOTE: Bracing shall consist of at least one vertical angle 50 x 50 mm x 16 gauge and one diagonal angle of the same size. The spans listed above may be increased if supported by structural calculations. Refer to para. 2.9.4.4.1.

- B. Longitudinal Sway Bracing: Longitudinal sway bracing shall be provided at 12 m intervals. All runs shall have one longitudinal brace minimum. Branch lines, walls, or floors shall not be used as sway braces.
- C. Vertical Runs: Vertical runs of piping shall be braced at not more than 3 m vertical intervals. For tubing, bracing shall be provided at no more than 1.2 m spacing. Vertical braces shall be above the center of gravity of the span being braced. Branch lines, walls, or floors shall not be used as sway braces.
- D. Anchor Rods, Angles, and Bars: Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as specified below. Anchor rods, angles, and bars shall not exceed lengths given in the tabulation below.

Type	Size (millimeters)	Maximum Length* (meters)	Allowable Loads* (kiloNewtons)
Angles	38 x 38 x 6	1.5	25.5
	50 x 50 x 6	2.0	34.5
	64 x 38 x 6	2.5	43.5
	75 x 64 x 6	2.5	48.0
	75 x 75 x 6	3.0	53.0
Rods	91	1.0	16.5
	22	1.0	22.0
Flat Bars	38 x 6	0.4	14.0
	50 x 6	0.4	18.0
	50 x 10	0.5	28.5
Pipes (40s)	25	2.0	18.0
	32	2.8	24.5
	40	3.2	29.5
	50	4.0	39.5

\*Based on the slenderness ratio of  $l/r = 200$  and ASTM A 36 steel, where  $l$  is the length of the brace and  $r$  is the least radius of gyration of the brace.

- E. Clamps and Hangers: Clamps or hangers on uninsulated pipes shall be applied directly to pipe. Insulated piping shall have clamps or hangers applied over the insulation utilizing high-density inserts and pipe protection shields.
- F. Bolts: Bolts used for attachment of anchors to pipe and structure shall be not less than 13 mm diameter.

#### 2.9.9.7.6 Sway Braces for Ducts

- A. Braced Ducts: Bracing details and spacing for rectangular

and round ducts shall be in accordance with SMACNA-12, including Appendix E. Select the appropriate SMACNA Seismic Hazard Level (SHL)

- B. Unbraced Ducts: Hangers for unbraced ducts shall be positively attached to the duct within 50 mm< of the top of the duct with a minimum of two #10 sheet metal screws. Unbraced ducts shall be installed with a 150 mm minimum clearance to vertical ceiling hanger wires.

#### 2.9.9.7.7 Sway Braces for Conduit

Conduit shall be braced as for an equivalent weight pipe.

#### 2.9.9.7.8 Equipment Sway Bracing

Equipment sway bracing shall be provided for items supported from overhead floor or roof structures. Braces shall consist of angles, rods, wire rope, bars, or pipes arranged as shown and secured at both ends with not less than 13 mm bolts. Braces shall conform to paragraph Anchor Rods, Angles, and Bars. Sufficient braces shall be provided for equipment to resist a horizontal force equal to the Lateral Force Coefficient (g) times the weight of equipment without exceeding safe working stress of the bracing components. Details of equipment bracing shall be submitted for approval. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

- A. Suspended Equipment: Select the appropriate lateral force coefficient (as a portion of gravity) according to the seismic zone:

\*The values listed above assume the equipment is nonrigid or flexibly mounted above grade in the building. Equipment weighing more than one-fifth of the dead load of off-grade slabs at the equipment level or equipment weighing more than one-tenth of the building weight must be checked by structural analysis to conform with building seismic provisions. The following items shall be checked structurally: Equipment supported by large pole or frame; Storage tanks for water and oil; Storage racks with upper storage level more than 2.4 m in height; Smoke stacks taller than 15 m in height.

- B. Floor or Pad Mounted Equipment:

Shear Resistance: Floor mounted equipment shall be bolted to the floor. Requirements for the number and installation of bolts to resist shear forces shall be in accordance with paragraph Anchor Bolts.

Overturning Resistance: The ratio of the height of the equipment (measured from the base to the center of gravity of the equipment) to the minimum distance between anchor bolts shall be

used to determine if overturning forces need to be considered in the sizing of anchor bolts. If this ratio is greater than the values listed below, then the bolt values in paragraph Minimum Bolt Sizes, Cast-In-Place Anchor Bolts shall not be used and calculations shall be provided to verify the adequacy of the anchor bolts for combined shear and overturning.

#### 2.9.9.7.9 Miscellaneous Equipment

- A. Rigidly Mounted Equipment: Rigidly mounted equipment is defined as having a period of vibration of 0.06 seconds or less. Equipment with a fundamental period greater than 0.06 seconds should be assumed to be flexibly mounted or nonrigid. For ground-mounted equipment use 2/3 of the values listed below. Examples of items that may require additional reinforcements (internally) to meet the specified requirements include boilers, chillers, and engine-driven generators, which consist of a number of individual components built into an assembly by the manufacturers. For emergency generators, auxiliary items required for the generator to operate, such as battery racks and day tanks, shall be included. Select the appropriate lateral force coefficient (as a portion of gravity) according to the seismic zone:

Examples Rigidly Mounted Equipment: The following are examples of specific equipment to be constructed and assembled to withstand the horizontal Lateral Force Coefficient (g) times the operating weight of the equipment, at vertical center of gravity of the equipment without causing permanent deformation, dislocations, separation of components, or other damage, which would render the equipment inoperative for significant periods of time following an earthquake: Boilers; Chillers; Air-Handling Units; Water Heaters; Transformers; Switch Boards and Switch Gears; Motor Control Centers; Free Standing Electric Motors.

- B. Nonrigid or Flexibly-Mounted Equipment: Nonrigid or flexibly-mounted equipment shall be constructed and assembled to resist a horizontal lateral force of 0.75 times the operating weight of the equipment at the vertical center of gravity of the equipment.

#### 2.9.9.7.10 Lighting Fixtures in Buildings

For electrical requirements for building see Electrical.

### 2.10 ELECTRICAL REQUIREMENTS

#### 2.10.1 Engineering, Installation, and Testing Standards

##### 2.10.1.1 Engineering Design, Installation and Testing Standards

Engineering design, installation and testing of electrical and other systems listed herein for this facility shall comply with the applicable requirements of the following and other applicable standards listed in Section 01010 of this RFP: MIL-HDBK-1190, MIL-HDBK-1008C, NFPA 70 (National Electrical Code), NFPA 70E, NFPA 72, NFPA 101,

National Electrical Safety Code and TM 5-811-1, ANSI C-2 National electric safety code, AFJ-MAN 32-1080, AFI 32-1065, Illuminating Engineering Society Application and Reference Handbooks, Institute of Electrical and Electronic Engineers, Insulated Power Cable Engineers Association, National Electrical Manufacturer's Association, Underwriters' Laboratories Inc., American National Standards Institute, the American Society for Testing and Materials, and Telecommunications Industry Association/Electronic Industries Association TIA/EIA 568-A, TIA/EIA 569-A, TIA/EIA 607, EIA TSB 67, Insulated Cable Engineers Association ICEA S-80-576, and ICEA S-83-596.

#### 2.10.1.2 UL Label

The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted.

#### 2.10.1.3 PCB Standards

All new electrical equipment shall be supplied with no PCB's. New fluorescent lighting fixture ballasts shall be clearly marked "No PCB's".

#### 2.10.1.4 Design Specification

Unless otherwise directed under other sections of this RFP, provide all applicable, edited CEGS guide specifications for each of the major electrical system described in section 9.0 ELECTRICAL. Following is a listing of many applicable CEGS guide specifications:

- CEGS 13110 Cathodic Protection System (Sacrificial Anode) or
- CEGS 13112 Cathodic Protection System (Impressed Current).
- CEGS 13851 Fire Detection/Alarm System, Addressable System
- CEGS 13852 Fire Alarm Reporting System Radio Type
- CEGS 16263 Electrical Generator
- CEGS 16311 Main Electrical Station and Substation
- CEGS 16370 Electrical Distribution System, Aerial
- CEGS 16375 Electrical Distribution System, Underground
- CEGS 16410 Auto Transfer Switches
- CEGS 16415 Electric Work Interior
- CEGS 16528 Exterior Lighting Incl Security and CCTV Applications
- CEGS 16670 Lightning Protection
- CEGS 16710 Premises Distribution System (for Telephone & Data)
- CEGS 16711 Telephone Systems Outside Plant

#### 2.10.1.6 Power Outages Coordination

**Dilligent effort shall be made to keep downtime to a minimum by scheduling power outages in non-working hours.** All power outages, regardless of point of inception e.g. (at the substation, exterior feeder and/or any other circuit switching); shall be well coordinated with all affected parties including Contracting Officer, User and/or other related personnel.

## 2.10.2 Site Considerations

### 2.10.2.1 Drawing Sheets

All electrical drawing sheets shall be prepared per A/E Design Guide and applicable Cad standards.

### 2.10.2.2 Exterior Duct Lines And Duct Banks

12 KV electrical and communications duct lines shall each be 103 mm [4 inch] thin-wall concrete encased (Type EB- encased) in a duct-bank. **Duct-bank shall be a minimum 915mm (36") under paved and other than paved areas, unless superseded by attached version of HAF Base Standard for more stringent requirements.** Concrete encasement shall be 78 mm [3 inch] minimum on all sides, with 78 mm spacing between adjacent duct walls in the same run. Between adjacent power and communications ducts in the same run, provide 103 mm [4 inch] spacing between adjacent duct walls. Secondary electrical duct lines shall be thin-wall concrete encased ducts under paved areas and heavy-wall ducts under other than paved areas. Secondary service ducts shall be minimum 103 mm diameter, while secondary ducts to loads such as exterior mechanical equipment shall be a minimum of 27 mm [1 inch] diameter. Minimum burial depth of direct buried ducts shall be 762 mm [30 inches] to top of ducts. **Minimum burial depth of concrete encased duct banks shall be 915mm [36 inches] to top of finished grade.** Total distance of curved duct lines between manholes/pullboxes shall be kept to 92 meters [300 feet]; the curve shall not have a radius of less than 8 meters [25 feet]. Maximum distance of straight communication duct lines shall be kept to 145 meters [475 feet] and 180 meters [600 feet] for primary electrical duct lines. Repair all disturbed surfaces equivalent to existing conditions prior to boring.

#### 2.10.2.2.1 Duct Lines Under Buildings

Duct lines for primary electrical cables shall not pass under buildings. Duct lines for secondary electrical cables for connecting to service entrance panelboards shall be kept to a maximum of 1 horizontal bend, excluding vertical sweeps. Horizontal bends in secondary duct lines shall have a radius of 8 meters [25 feet] minimum to maintain maximum allowable cable pulling tensions.

### 2.10.2.3 Phasing of Site Demolition Work with New Work

Site Demolition work described herein shall be phased with new work described herein to keep power outages to an absolute minimum.

## 2.10.3 Site Electrical and Communications

### 2.10.3.1 Existing Site Electrical Demolition

Existing primary power at the site is underground\overhead at 12 kV, 3 phase 3-wire. Discontinuation of existing electrical system around recently removed building 271 may be needed and shall be coordinated with Contracting Officer. All existing (exterior) electrical equipment and wiring (meant for removed building 271), shall be removed upon coordination with Contracting Officer and\or Base operation and

maintenance.

### **2.10.3.2 New Site Electrical**

The new site electrical power system comprises of following work elements.

a) Upgrading of existing substation #5 to install a new outdoor type power transformer sized to support new facility but not exceeding 10 MVA, 44\12 kv. Substation modifications will include installation of all necessary structural\electrical hardware, 15kv electrical switchgear and 12kv feeder terminations. A new 12kv underground feeder system comprising of 2-12KV feeders in a 4-way duct-bank shall be extended northerly (as necessary) from substation # 5 (new) switchgear, then continuing easterly along Southgate Avenue {staying within area bounded by southern sidewalk along Southgate Avenue and north of buildings 240(GTE-Gas Test Cell) & 244}; then continuing southerly along westside of Southgate Avenue to the intersection of 6<sup>th</sup> street. At this point Contractor shall jack and bore under the T intersection allowing easterly transition of 12kv feeder along 6<sup>th</sup> Street, assuring 12kv feeder is installed under northerly sidewalk area of 6<sup>th</sup> street; to terminate into 2 of the three switched pad-mounted transformers (connected in loop-feed mode) at the project site.

Offerors shall assume that each existing building has a complete set of service utility laterals namely elect, comm, gas, water, steam, sanitary sewer, industrial waste, roof drain lines to storm drain system for roofs with parapet walls. The Contractor shall address and cross these lines if excavation is between the building and applicable utility main. After award, the Offeror shall research record drawings at the Base Civil Engineer's Office to determine location of lateral utility lines in the project area and apply the information to the design and construction of the and show the information on the project drawings.

In addition, after award of the contract the Gov't will surface-mark all active and inactive underground utility lines (with noting active status) in the applicable excavation areas as requested by the Offeror.

Traffic on Southgate Avenue is very heavy and therefore it is required that electrical construction shall not disrupt traffic movement.

It is required that all streets must remain open to traffic at all times.

### **2.10.3.3 Limited 12 KV Feeder Reconfiguration and 2 Pad-mounted Transformers Relocations At Project Site**

#### **2.10.3.3.1 Concept (1<sup>st</sup> Relocation)**

Existing 225KVA transformer near building 277 shall be removed by disconnecting 12KV feeder terminations at Switch 5D-7,8,9,10 and discontinuing the secondary service to exiting building 287. 12KV feeder shall be abandoned in place and the transformer shall be relocated near the existing building 287.

A new 4-way pad-mount switch shall also be installed in the same



proximity near relocated transformer and the building 287; assuring easy access to the equipment and away from vehicular traffic.

Approx. 150' west of building 287, on the westerly side of A-Lane; there is a manhole with 2-12KV feeders running thru it (refer project site feeder map). It is required that Contractor shall intercept one 12KV feeder, splicing and terminating the ends into two switch positions of new 4-way switch. Utilize 3<sup>rd</sup> position of the switch to energize the relocated 225KVA transformer. Also install and reconnect new secondary service conductors to building 287.

#### 2.10.3.3.2 Construction Modification and Contractor's Proposal (1<sup>st</sup> Relocation)

The Contractor's proposal shall include installing the apron\tow way directly over the existing 12KV feeders that cross the site along A-Lane (refer electric utility drawing). Existing concrete encased ducts are suitable to support aircraft traffic over it. If the Contractor demonstrates to the Contracting Officer that the 12KV lines are found to be impeding the construction, the Contractor shall reinstall 12KV feeder ducts at suitable depth to support the weight of apron\tow and the aircraft traffic.

#### 2.10.3.3.3 Concept (2<sup>nd</sup> Relocation)

Presently there is a transformer (unknown size) located on A-Lane across from building 286 and is feeding 4 pole-mounted light clusters. It appears that it will interfere with the construction of new project building. If Contractor deems it necessary to relocate this transformer because of its interference with the footprint of new building, Contractor may do so to a location 50 feet south from its present location; on the same side of A-Lane. Reconnect the primary and secondary circuits of the transformer to restore power.

#### 2.10.3.4 Electrical\Communication Drawing Inserts

Herein are included 8 electrical inserts for reference purposes, 4 inserts pertain to recent substation modifications, 3 inserts pertain to electric\communication\fiber site utilities and 1 insert pertains to project site feeder map.

#### 2.10.3.5 New Communications Outside Plant Service

All outside cable shall be installed by the Base. Provide a 4-103 mm concrete encased ductbank from existing splice point outside the new building to communications room. Provide in one of the 4 new 103 mm ducts, four 27mm innerducts. Coordinate with the Communication Squadron for point of entrance of the 4-103 mm ducts into comm. Room. Coordinate fiber optic cable and splice installation with Base Communication Squadron, POC Master Sargent Mike Hendricks @ 801-777-4411.

#### 2.10.4 Manholes

##### 2.10.4.1 General

New manholes shall be either pre-cast or poured in place. Manhole

cover shall be cast iron, round - 749mm in diameter, traffic rated and shall be equipped with ribbed frame as required and cover handle. Manholes shall be provided with two cable racks on each wall, shall have a 3000mm ground rod with top 100mm exposed, and shall have a sump with cover for drainage. Manholes shall have Pulling-in irons installed on each wall, positioned 150mm to 300mm below duct entrances. Minimum manhole size shall be 4'x4'x4' for communication and electric. Provide the word "ELECTRIC and/or COMMUNICATIONS" on the cover. Power manholes shall be 2744 mm L x 1800 mm W x 2134 mm D [9 ft x 6 ft x 7 ft D]. Punch out the sump prior to setting the manhole. Provide 3716 square cm [24 inches square] of gravel under the punched out sump. Install manholes with long wall parallel to the main duct run. Before entering any existing communications or electric manholes, first coordinate with the Contracting Officer and with either the Directorate of Information Management (DOIM) at the Hill Air force base's communication squadron or the Exterior Electric section of the Department of Public Works. Manhole walls, top and floor shall be 200mm thick, and sump walls and floor shall be 100mm thick. Floor shall be sloped to drain. Manhole locations should be coordinated with site civil and landscape work.

#### 2.10.4.2 Cable Markings

A color-coded plastic warning tape shall be placed at least 100 mm [4"] wide within the trench above all buried utility lines as follows:

RED: electric  
ORANGE: communication

#### 2.10.4.3 Pad-Mounted Transformers

Provide a deadfront, tamper-resistant pad-mounted compartmental transformer sized with a rated capacity of not less than 100 percent of the building demand load plus 25% spare. Transformer shall be loop feed with pressure relief, oil gauge, LBOR switch, primary fuses, primary surge arresters, and two 2-1/2 % taps above and four 2-1/2 % taps below normal. Transformer must be certified as PCB free by a certified testing laboratory and a copy of certification given to the government for record keeping. Install on reinforced concrete pad sized to fit transformer. Fuses in transformer primary and the main circuit breaker in the building main distribution panel shall be coordinated with other protection devices down stream of them inside the building. Location of oil-filled transformer installation shall comply with the following: concrete or masonry buildings within 7.62 meters [25 feet] of a transformer shall have: 1) no window openings in first story walls within 3.05 meters [10 feet] horizontal of transformers, 2) windows beyond 3.05 meters [10 feet] and up to 7.62 meters [25 feet] horizontally from the transformers shall be protected, using either wired glass in steel sash or glass block, 3) window openings in second and third story walls directly above transformers shall be protected using either wired glass in steel sash or glass block, and 4) overhanging eaves, where they exist, shall be noncombustible. Buildings located 7.62 meters [25 feet] or more from oil-insulated transformers do not require fire exposure protection. Provide one portable fire extinguisher to be stored near the transformer. Transformers shall use less flammable liquid, as per NFPA 70 Article 450-23. The transformer primary voltage shall be 12000 volts Delta Primary- and 480/277 volt WYE secondary. The transformer

shall be specified with a 55 degree Celsius temperature rise at rated kVA and to have an insulation upgraded to 65 degree Celsius (55/65 degree C rise). The core/coil assembly shall be wound core type with five-legged design and with copper windings. The assembly shall be designed to reduce losses and noise and provide adequate short-circuit strength and heat dissipation. Transformer shall preferably be located in the near vicinity to the Electrical room where the main service entrance distribution switchboard is located. If the main service entrance distribution switchboard is located in the Mechanical room, then it would be preferable for the transformer to be located within the equipment yard hidden by a screening wall and located so as not to interfere with service access to the Mechanical Room and not immediately adjacent to pedestrian walkways.

#### 2.10.4.4 Power System Analysis

A full Primary Coordinated Power System Analysis is required for this project.

##### 2.10.4.4.1 Available Fault Current

To obtain data on the available fault current at this facility, contact Mr Robert Miller at 801-777-2087.

#### 2.10.5 Corrosion Control

Provide cathodic protection for any buried/submerged metallic utility system (piping or tanks). The cathodic protection survey and design must be performed by a National Association of Corrosion Engineers (NACE) Accredited Corrosion Specialist, NACE Certified Cathodic Protection Specialist, or a Registered Professional Corrosion Engineer. This accreditation and/or registration must have been obtained in the field of cathodic protection. Cathodic protection system shall be in accordance with NACE RP-01-69 and NACE RP-01. Design anodes for a 20 year life minimum.

#### 2.10.6 Building Electrical

Extend 3-phase, 480v feeders as necessary, from pad-mounted transformers, preferably to form a secondary selective distribution network, to serve new Corrosion Control facility at following services;

- a) 480v, 3-phase, 4 wire,
- b) 208v, 3-phase, 4 wire,
- c) and 120v, 1-phase, 3 wire.

##### 2.10.6.1 UG Secondary and Service Entrance Equipment

Provide 3-phase, 4-wire secondary underground service in 103 mm [4 inch] conduits from the building transformer to a new building service entrance equipment and distribution switchboard equipment, located inside the Mechanical/Electrical room. Use multiple underground conduit and conductor runs in parallel to avoid excessively large conductors and conduit. Ensure service equipment is properly configured to accept multiple conductors for each phase at the bus and at each main circuit breaker phase lug. Provide a UL listed service

entrance switchboard with a 3-pole main circuit breaker type solid state with 100% rated demand load carrying capacity for the selected amp-trip rating plug. For ease of maintenance, use only circuit breakers as a disconnecting means in service equipment and all sub-panelboards. Size equipment and feeder ampacities to be adequate for the estimated demand loads plus a reserve of approximately 25 percent for future growth. Unless otherwise directed, provide at the main distribution switchboard, a digital power monitor meter with the following minimum features: disturbance monitoring with sag/swell detection; true RMS metering accurate to the 31st harmonic; at least 50 displayed meter values, including Min/Max displays for each of those values; power quality readings including THD and K-Factor, Crest factor; a rear-mounted RS-485 communications port; expanded nonvolatile memory; with 12 cycle Waveform capture; and with pulse initiating capability compatible with the existing central station EMCS on base. Provide the floor mounted service switchboard anchored on a concrete pad that is 77 mm [3 inches] above the finished floor.

#### 2.10.6.2 Spare Capacity

The electrical distribution system shall be designed to have a minimum 25 percent spare capacity for all loads. This includes providing spare circuit breaker expansion capability in the service entrance switchboard and all panelboards. Panelboards that are flush mounted shall have spare conduits stubbed out to an open area of accessibility.

#### 2.10.6.3 Secondary Distribution

The electrical service to the building shall preferably be at 480/277 volts, 3-phase, 4-wire and at 120/208 volt, 3-phase, 4 wire to efficiently serve new lighting, large HVAC loads and other loads. If the service is at 480/277 volts, then provide dry-type transformers to step down 480V to 208/120 for receptacles, small motors and other user equipment. Provide K4-factor rated with shielded isolation dry-type transformers to best serve computers and other sensitive equipment that produce harmonics, located in administrative areas and other support areas. Protection against external/internal generated transient surge voltage spikes shall be provided by Transient Voltage Surge Suppression (TVSS) units placed at the main switchboard and at each dry-type transformer secondary connected to distribution panelboards that provide 120 volt power to sensitive personal computer and other office type equipment loads. Locate the main distribution switchboard in the Electrical room. From the main switchboard and/or dry type transformers, provide feeders to branch circuit panelboards in the Electrical and Mechanical rooms to best feed smaller mechanical motor loads, utility convenience receptacles, and other miscellaneous dedicated electrical systems circuit that require the lower 208/120 voltage. Avoid mounting panelboards in storage rooms, janitor rooms, in corridors and office or administrative rooms. Panelboards shall be mounted to minimize the voltage drop. Administrative areas and offices shall be provided dedicated panelboard(s) for branch circuits that serve sensitive equipment, such as personal computers, fax machines, laser printers, copiers, communications racks, and other office type equipment. All 208/120 volt panelboards shall be located within 30.48 meters [100 feet] max. and all 480/277 volt panelboards shall be connected within 70.11 meters [230 feet] max. of their connected loads to reduce branch circuit length and corresponding voltage drop. Provide

separate branch circuit panelboards, preferably at 480/277 volts, for lighting circuits and locate them in the Electrical and Mechanical rooms only. Allow adequate clearance between panelboards and other equipment. Electrical panels shall be flush mounted when installed outside of the Electrical or Mechanical rooms and shall be of suitable depth for flush mounting in the wall. All new circuit breakers shall be capable of being locked in the OFF position. Loadcenters are not allowed. All panelboards shall be 42 pole, 225 amperes minimum, with a main breaker, and with busses made of copper. Provide 25% spare capacity and 25% spare circuit breaker spaces in all new panelboards. Paint all panelboards to match the color of the adjacent walls.

#### 2.10.6.4 Transient Voltage Surge Suppression (TVSS)

Provide a type Liebert model, or equal. Provide transient voltage surge suppression at the secondary of dry-type transformers that feed distribution panelboards that in turn feed sensitive personal computer equipment loads, and at the service entrance main distribution switchboard. TVSS devices, 480/277 volts, shall comply with IEEE C62.11 and C62.45 test procedures for Category C3 at the service entrance switchboard and Category B3 at a dry-type transformer secondary: standard 1.2/50 microsecond - 8/20 microsecond combination wave, voltage rating of 20 kV for C3 (6 kV for B3) and current rating of 10 kA for C3 (3 kA for B3). Suppression modes for the each TVSS unit device shall be all possible coupling modes including line-to-line (L-L)/line-to-neutral (L-N), line-to-ground (L-G) and neutral-to-ground (N-G), as required to accommodate the service. Specifically, the protected modes shall include the following for the indicated services:

<u>Service</u>	<u>Location</u>	<u>Conductors</u>	<u>Protected Modes</u>
3-phase, 4 wire, WYE	Service Entrance	3 wire + N + G	L-L/L-N, L-G, N-G

TVSS devices shall comply with IEEE Std. 142 and NFPA 70 Article 280. TVSS device types shall be selected to best match the types of panels (and loads) protected. Each TVSS device enclosure shall be NEMA 4 or NEMA 12 construction, factory primed and painted. The unit shall not short circuit or crowbar the power flow that would result in an interruption to the load. Unit shall not require interruption of building power for maintenance.

Indicating LED lights, on all protection modes, to mean on-line continuous monitoring of surge protection device/protection mode. The surge protection device shall be considered to have failed if a normally on indicating light is off. The TVSS units shall have transient suppression capability that is BI-POLAR and BI-DIRECTIONAL, treating negative transients identically to positive transients, and achieve a system response time of 5 nanoseconds or less. TVSS manufacturer shall have regularly engaged in the manufacture of TVSS products for minimum category C1 (IEEE 62.41) and whose products have been in satisfactory services for not less than 3 years. TVSS devices shall bear the UL label and be UL listed per UL 1449. TVSS devices shall be unconditionally warranted against internally/externally induced surge damage and against defects in material and/or workmanship for a minimum of 5 years from the date of installation. The manufacturer's turn around period for repair/replacement of the TVSS units shall be no more than 48 hours. Provide a 60A minimum, 3-pole,

thermo-magnetic breaker in the switchboard or panelboard as a disconnect for the TVSS in order to electrically isolate the TVSS without interrupting service to the building. Number and size of cables for the TVSS input shall be as recommended by TVSS manufacturer. Locate the 60A disconnect breaker to keep cable length to be as short and as straight as possible. The input conductors shall be twisted together, or tie-wrapped, to reduce the input impedance. Upon completion of installation, a TVSS manufacturer's representative shall provide instruction to the User that shall consist of:

- A. Two hour instruction period for the Building maintenance personnel and the DPW interior electrical shop personnel. The instruction shall consist basically of how to understand when the unit is operating normally and when the unit has failed. If the unit is field repairable, the procedure to follow when interior components need to be replaced and then how to verify that the TVSS device is functioning to manufacturer's specifications.
- B. Location of the nearest approved distributor, service location and telephone numbers.
- C. A complete set of manufacturer's product data, three sets of Operation & Maintenance manuals and shop drawings.

#### 2.10.6.5 Motor Control Centers

Serve 3-phase motor loads for mechanical equipment from a Motor Control Center(s) (MCC) located in the Electrical\Mechanical Room(s). The MCC shall be sub-fed from the main service entrance switchboard. The MCC shall include two variable frequency drives (VFD); one VFD for the HVAC supply fan and one VFD for the return fan.

#### 2.10.6.6 Equipment Interrupting Capacity

Perform short circuit calculations to determine fault current available at service equipment, panelboards, motor control centers, safety switches, and enclosed circuit breakers. Provide equipment with sufficient short circuit interrupting capacity to withstand these calculated fault current levels. Circuit breakers shall be fully rated type.

#### 2.10.6.7 Secondary Electrical Wiring and Conduit

Wiring shall consist of 600-volt insulated single conductors type THWN, THHN, or THW conforming to UL 83, installed in raceways consisting of electrical metallic tubing, intermediate metal conduit (IMC), or rigid galvanized steel conduit (RGS). Non-metallic sheathed cables and Electrical Non-Metallic Tubing (ENT) shall not be provided. Conductors shall be copper, only. Branch-circuit conductors shall not be smaller than No. 12 AWG. Number of current-carrying conductors per conduit shall be kept to 6 maximum to limit the adjustment factor reduction of each conductor to 80 percent, per Note 8 of ampacity table 310-16. Provide each single 20 amp branch circuit for either lighting or convenience receptacles with a dedicated neutral conductor. Provide a shared neutral of minimum size #10 THHN for two or three 120 volt 20 amp branch circuits of phases A-B or A-B-C for lighting or convenience

receptacles. Conductors for branch circuits of 120 volts more than 30.48 meters long and of 277 volts more than 70.11 meters long, from panel to connected load, shall be no smaller than No. 10 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal circuit conductors shall be not less than No. 16 AWG. Class 3 low-energy, circuit conductors shall be not less than No. 22 AWG. Insulation type shall be TW, THW or TF conforming to UL 83 and suitable for the application according to the National Electrical Code (NEC). Unless otherwise noted, insulation type shall be suitable for the application according to the NEC. Where lighting fixtures require 90-degree Centigrade conductors, provide only conductors with 90-degree C insulation or better. Routing of raceways and cables shall be parallel or perpendicular to walls and ceilings and shall not be run diagonally across rooms. Firestop any cable or raceway penetrations through fire walls to meet fire resistance ratings required in ASTM E 814 or UL 1479 or CEGS 07270 FIRESTOPPING. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by NFPA 70. Raceways shall not be installed under the firepits of boilers steam pipes and hot-water pipes. Raceways shall be concealed within finished walls, suspended ceilings, and floors. Raceways crossing structural expansion joints or seismic joints or wall foundations shall be provided with suitable expansion fittings on both sides, or other suitable means to compensate for the building expansion and contraction. Other expansion fittings shall be provided for raceways as further required in NFPA 70.

#### 2.10.6.8 Conduit Stub-Ups

Where conduits are to be stubbed up through concrete floors, a short sweep shall be installed below grade to transition from the horizontal run of conduit to a vertical run. A conduit coupling fitting, threaded on the inside shall be installed, to allow terminating the conduit flush with the finished floor. Wiring shall be extended in rigid threaded conduit, (IMC) or (RGS) only, to equipment, except that where required, flexible conduit may be used 150 mm [6 inches] above the floor. Empty or spare conduit stub-ups shall be plugged flush with the finished floor with a threaded, recessed plug.

##### 2.10.6.8.1 Below Slab-On-Grade or in the Ground

Electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be RGS or IMC. Rigid galvanized steel or IMC conduits installed below slab-on-grade or in the earth shall be field wrapped with 0.254 mm thick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

##### 2.10.6.8.2 Installing Conduit in Slabs Including Slabs on Grade

Conduit installed in slabs-on-grade shall be RGS or IMC. Conduits shall be installed as close to the middle of concrete slabs as practicable without disturbing the reinforcement. Outside diameter shall not exceed 1/3 of the slab thickness and conduits shall be spaced not closer than 3 diameters on centers except at cabinet locations where the slab thickness shall be increased as approved by the Contracting Officer. Where conduit is run parallel to reinforcing

steel, the conduit shall be spaced a minimum of one conduit diameter away but not less than 25.4 mm from the reinforcing steel.

#### 2.10.6.8.3 Conduit Supports

Except where otherwise permitted by NFPA 70, conduits and electrical metallic tubing (EMT) shall be securely and rigidly fastened in place at intervals of not more than 3 meters and within 900 mm of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, beam clamps or ceiling trapeze. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structure. Loads shall not be applied to joist bridging. Attachment shall be by wood screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Cutting the main reinforcing bars in reinforced concrete beams or joists shall be avoided when drilling holes for support anchors. Holes drilled for support anchors, but not used, shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Raceways shall not be supported using wire or nylon ties. Raceways shall be independently supported from the structure. Upper raceways shall not be used as a means of support for lower raceways. Supporting means will not be shared between electrical raceways and ceiling grids. Except where permitted by NFPA 70, wiring shall not be supported by ceiling support systems. Conduits shall be fastened to sheet-metal boxes and cabinets with two locknuts where required by NFPA 70, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

#### 2.10.6.8.4 Wiring Temperature Rating

Where wiring is connected to devices rated at 100 amperes or less, the ampacity limit listed for 60 degrees C wire in allowable ampacity table 310-16 in the NEC shall be used whether or not the wire is rated at a higher temperature. For wiring connected to devices rated at over 100 amperes, wiring rated at 75 degrees C or greater shall be used. The 75 degree ampacity limit for wire shall be used whether or not the wire is rated at a higher temperature. The ambient temperature derated ampacity of higher temperature insulated wire may be used as long as the calculated derated ampacity is not less than the ampacity limits of the 60 degrees C wire (for 100 amps or less branch circuits) or less than the ampacity limits of the 75 degrees C (for greater than 100 amps circuits). These requirements are to ensure that higher temperature wire does not thermally overheat the equipment wire/cable terminals that are rated at the lower temperature of 60 degrees C or 75 degrees C.

#### 2.10.6.8.5 Cable Tray



NEMA VE 1 cable trays shall form a wireway system, and shall be of nominal 77 mm [3 inch] depth and 40 or 46 mm [12 or 18 inches] wide, unless larger dimensions are required to maintain a maximum 50 percent cross sectional area cable fill. All cable tray outside of the telecommunications closets shall be trough type and installed above the acoustical ceiling, and inside the telecommunications closet shall be ladder type and installed at 152 mm [6 inches] above equipment racks, and wall plywood backboards. Contractor may provide, instead, cable tray equivalent to Flextray or EZ Tray inside and outside of telecommunications closets. Cable trays shall be constructed of aluminum, copper-free aluminum or zinc-coated steel. Trays (including Flextray and EZ Tray) shall include dimension and direction-transition fittings, splice and end plates, cable dropout chute fittings, conduit-end tray fasteners and miscellaneous hardware all provided by the cable tray manufacturer. Edges, fittings, and hardware shall be finished free from burrs and sharp edges. Conduits terminated at cable trays shall be provided with insulated throat bushings. Cable tray transitions fittings shall have not less than the load-carrying ability of straight tray sections and shall have the manufacturers's minimum standard radius. Radius of bends shall be 300 mm [12 inches]. Routing of cable trays shall be parallel or perpendicular to walls and ceilings and shall not be run diagonally across rooms. Cable trays shall penetrate fire rated walls and partitions in accordance with Article 300 of NFPA 70. Firestop any cable tray penetrations through fire walls to meet fire resistance ratings required in ASTM E 814 or UL 1479.

#### 2.10.7 Motors

Motors above 373 watts [1/2 horsepower] shall be three phase. 373 watts [1/2 horsepower] and smaller motors may be rated at 115 volts single phase. Provide protection against single phasing when a phase loss occurs for all three phase motors. Provide high efficiency motors for those motors operating over 750 hours per year. Follow the guidelines in NEMA Standard MG-1. Motors larger than 7.5kW [10 HP] shall be furnished with power factor correction. Unless otherwise specified, all motors shall have open frames, and continuous-duty classification based on a 40 degree C ambient temperature reference. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low-starting-current characteristics, unless other characteristics are specified in other sections of these specifications or shown on contract drawings. The Contractor shall be responsible for selecting the actual horsepower ratings and other motor requirements necessary for the applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed. Motors connected to VF Drives shall have a 1.15 service factor, but the connected load shall be sized to not exceed the 1.0 service factor of the motor. Provide motor winding thermal sensing thermistors (PTC) in motors to be connected to VF Drives. Variable Frequency Drives, as specified, shall be provided for the HVAC supply and return fans.

##### 2.10.7.1 Motor Control

Each motor or group of motors requiring a single control and not

controlled from a motor-control center shall be provided under other sections of these specifications with a suitable controller and devices that will perform the functions as specified for the respective motors. Each motor of 1/8 hp or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating. Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motors directly, provided the devices used are designed for that purpose and have an adequate horsepower rating. When the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit. When combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch shall be provided for the manual control; when the automatic-control device actuates the pilot control circuit of the magnetic starter, the latter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low- or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

## 2.10.8 Variable Frequency Drive

### 2.10.8.1 General

This section provides specification requirements for variable frequency drives (VF Drives) for use with NEMA B design AC squirrel cage induction motors. The Contractor shall provide the following: a) provide the Contracting officer with the VF Drive manufacturer's written concurrence that the output of the Drive is compatible with the design and construction of the associated motor to be supplied by the Drive; b) a VF Drive manufacturer's representative to field test, adjust and certify all installed VF Drives for satisfactory operation with motor load running under all design conditions.

### 2.10.8.2 Warranty

Provide a 3-year parts warranty, on materials and workmanship, and 1-year labor warranty from the date of field certification by manufacturer's representative of satisfactory operation. The manufacturer's turn around period to repair or replace the VF Drive shall be no more than 48 hours.

#### 2.10.8.3 Quality Assurance

The manufacturer of the VF Drive shall be a certified ISO 9001 facility. The VF Drive and all associated optional equipment shall be UL listed according to Power Conversion Equipment UL 508C. A UL label shall be attached inside each enclosure as verification. Every Power Converter (a component of the VF Drive) shall be tested with an actual AC Induction Motor 100% loaded and temperature cycled to the full range of the VF Drive. All VF Drive door mounted pilot devices shall be tested to verify successful operation. The VF Drive shall be submitted to a HI-Pot test with all enclosed devices mounted and wired, prior to shipment. Documentation shall be furnished to verify successful completion of all the above, upon request of the Contracting Officer.

#### 2.10.8.4 Frequency Conversion Components

Alternate control techniques other than pulse width modulated (PWM) are not acceptable. The VF Drive shall convert the input AC mains power to an adjustable frequency and voltage as defined in the following sub-paragraphs. The input power section shall utilize a full wave bridge design incorporating diode rectifiers (SCR's may be incorporated at 40 horsepower and above). The diode rectifiers shall convert fixed voltage and frequency, AC line power to fixed DC voltage. This power section shall be insensitive to phase rotation of the AC line. The DC bus shall have external connections for standby battery back-up or for linking multiple VF Drives with DC buses for management of regeneration power. The output power section shall change fixed DC voltage to adjustable frequency AC voltage. This section shall utilize Insulated Gate Bipolar Transistors (IGBTs) or Intelligent Power Modules (IPMs) as required by the current rating of the motor.

#### 2.10.8.5 Construction

- A. The VF Drive shall be mounted in a NEMA 1 or NEMA 12 enclosure with an external operated disconnect device. A mechanical interlock shall prevent an operator from opening the VF Drive door when the disconnect is in the on position. Another mechanical interlock shall prevent an operator from placing the disconnect in the on position while the VF Drive door is open. It shall be possible for authorized personnel to defeat these interlocks.
- B. Provisions shall be provided for locking all disconnects in the off position with up to three padlocks.
- C. Current limiting fuses shall be installed and wired to the AC Drive input.
- D. Provisions shall be made for accepting a padlock to lock the VF Drive enclosure door.

#### 2.10.8.6 Motor Data

- A. The contractor shall ultimately be responsible for obtaining all necessary motor(s) technical data from the motor or equipment manufacturer, to properly size the VF

Drive. The VF Drive shall be sized per the motor's maximum current requirements under breakaway torque demands, not per the motor horsepower rating. The Drive shall be sized to operate the AC motor(s) of the following equipment:

1. Equipment Name:

HVAC Supply Fan [\_\_\_\_], shown on Mechanical and Electrical drawings.

Motor Horsepower: \_\_\_\_\_, or as provided by the manufacturer

Motor maximum current at breakaway torque: \_\_\_\_\_Amps, unless otherwise indicated by manufacturer.

Motor full load amperes: \_\_\_\_\_Amps, or as provided by the manufacturer.

Motor RPM: 1800 @ 60Hz, unless otherwise indicated.

Motor voltage: 460V [ ]

Motor service factor: 1.15

2. Equipment Name:

HVAC Return Fan [\_\_\_\_], shown on Mechanical and Electrical drawings.

Motor Horsepower: as provided by the manufacturer.

Motor maximum current at breakaway torque: \_\_\_\_\_Amps, unless otherwise indicated by manufacturer.

Motor full load amperes: \_\_\_\_\_Amps, or as provided by the manufacturer.

Motor RPM: 1800 @ 60Hz, unless otherwise indicated.

Motor voltage: 460V [ ]

Motor service factor: 1.15

2.10.8.7 Application Data

- A. The VF Drive shall be sized to operate a Variable Torque Low Noise load.
- B. The speed range shall be from a minimum speed of 0.5 Hertz to a maximum speed of 400 Hertz.

2.10.8.8 Environmental Ratings

- A. The VF Drive shall be of construction that allows operation in a pollution Degree 2 environment, minimum.
- B. The VF Drive shall be designed to operate in an ambient temperature from 0 to +40 degrees C (+32 to 104 degrees F).
- C. The storage temperature range shall be -25 to +70 degrees C (-13 to 158 degrees F). The maximum relative humidity shall be 95% at 40 degrees C, non-condensing.
- D. The VF Drive shall be rated to operate at altitudes less than or equal to 1000 m [3,300 ft.]. For altitudes above 1000 m, de-rate the VF Drive by 1.2% for every 100 m 300 ft].

2.10.8.9 Ratings

- A. The VF Drive shall be designed to operate from an input

voltage of 480 VAC +10%, -5% three phase supply. Output voltage shall be 0 to maximum voltage, equal to input line voltage.

- B. The VF Drive shall operate from an input voltage frequency range from 47.5 to 63 Hertz.
- C. The displacement power factor shall not be less than .95 lagging under any speed or load condition.
- D. The efficiency of the VF Drive shall not be less than 96% at 100% speed and load.
- E. The overload current rating for variable torque (VT) shall be minimum 110%, for 1 minute; for constant torque (CT) shall be 150%, for 1 minute.
- F. The output carrier frequency of the VF Drive shall be selectable at steps of 2kHz up to 10kHz for A frame; 8kHz for B frame; and 6kHz for C frame, depending on VF Drive rating for low noise operation. No VF Drive with an operable carrier frequency above 10 kHz shall be allowed. Or, the VF Drive shall have a switching frequency dependent on load in the 2 to 4 kHz range without a fixed carrier.
- G. The output frequency shall be from 0.1 to 400 Hertz for VF Drives up to 75 HP. At horsepower above 75 HP, the maximum output frequency will be 200 Hertz.
- H. The VF Drive will be able to develop rated motor torque at 0.5 Hertz (60 Hz base), or at zero base, in a Sensorless Flux Vector mode using a standard induction motor without an encoder feedback signal.
- I. For motor thermal protection function when the motor is operating at slow speed for extended times, the VF Drive shall have a protection function that detects motor over temperature by wiring a motor thermistor (PTC) to a +24VDC voltage supply in the Drive. The VF Drive shall stop the motor and give a fault indication if the PTCs indicate motor over temperature.

#### 2.10.8.10 Protection

- A. Upon power-up the VF Drive shall automatically test for valid operation of memory, option module, loss of analog reference input, loss of communication, dynamic brake failure (if provided), DC to DC power supply, control power and the pre-charge circuit.
- B. The VF Drive shall be UL 508C listed for use on distribution systems with 22,000A RMS available fault current. The Power Converter shall meet short circuit withstand ability of 65,000 RMS symmetrical amperes as defined by NEMA ICS 7.1.09 and have the value listed on the VF Drive nameplate.

- C. The Power Converter shall be protected against short circuits, between output phases and ground; and between the logic and analog control outputs.
- D. The VF drive shall have a minimum AC undervoltage power loss ride-through of 200 msec. The VF drive shall have the user defined option of frequency fold-back to allow motor torque production to continue to increase the duration of the powerloss ride-through.
- E. The VF drive shall have a selectable ride through function which will allow the logic to maintain control for a minimum of one second without faulting.
- F. For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function will provide up to 5 programmable restart attempts. The programmable time delay before restart attempts will range from 1 second to 30 seconds, minimum.
- G. The deceleration mode of the VF Drive shall be programmable for normal and fault conditions. The stop modes shall be free-wheel stop (coast to stop), DC injection brake, Ramp-to-Stop/Hold.
- H. Upon loss of the analog process follower reference signal, the VF Drive shall be User programmable to do the following: Fault and stop; Alarm and maintain last reference (within 10%); Alarm and go to preset speed, which would be programmed to be minimum speed or maximum speed.
- I. Motor overload protection: The VF Drive shall have solid state I2t protection that is UL listed and meets UL 508C as a Class 10 overload protection. The minimum adjustment range shall be from .45 to 1.05 percent of the current output of the VF Drive.
- J. The VF Drive shall provide a motor phase loss function that monitors the status of the motor cable connection. During startup, if any of the motor phases are not connected the Drive shall refuse to start. The Drive shall have a user defined operation, during motor phase loss, of either a fault indication and stop, or no reaction.
- K. The VF Drive shall have a thermal switch with a user selectable prealarm that will provide a minimum of 60 seconds delay before over temperature fault. Or, the Drive shall provide access to the heatsink temperature parameter such that the user can monitor it.
- L. The VF Drive shall be provided with cooling air fan(s) and/or may utilize bonded or cast fin heatsink construction for maximum heat transfer. The cooling air must be clean and free from corrosive materials.
- M. The VF Drive shall have a programmable fold-back function that will anticipate a controller overload condition and

fold back the frequency to avoid a fault condition.

- N. The output frequency shall be software enabled to fold back when the motor is overloaded. There shall be 3 skip frequency ranges that can each be programmed with a selectable bandwidth of 2 or 5 Hz. The skip frequencies shall be programmed independently, back to back or overlapping.
- O. The VF Drive shall include phase to phase and phase to ground transient voltage surge protection wired to the incoming AC mains.

#### 2.10.8.11 Factory Settings, Field Adjustments and Configurations

- A. The VF Drive shall self-configure to the main operating supply voltage and frequency. No operator adjustments shall be required. The VF Drive shall be insensitive to incoming power phase sequence.
- B. The VF Drive shall be capable of determining the speed and direction of a spinning motor and adjusting its output to engage the motor at the rotating speed.
- C. Upon power-up, the VFD will automatically send a signal to the connected motor and store the resulting resistance data into memory. The inductance data will be measured during no-load operation when operating at a frequency between 20-60 Hz. The VFD will automatically optimize the operating characteristics according to the stored data.
- D. The VF drive will be factory pre-set to operate most common applications.
- E. A choice of three types of acceleration and deceleration ramps will be available in the AC Drive software; Linear, S curve, and U curve (or Linear, S1 curve, S2 curve, and S3 curve).
- F. The acceleration and deceleration ramp times shall be adjustable from .1 to 999.9 seconds.

- G. The volts per frequency (V/Hz) ratios shall be user selectable to meet variable torque loads, normal and high torque machine applications.
- H. The Drive shall retain and record operating frequency, Drive status, power mode, and fault type of the past 4 faults, minimum. Information shall be maintained in memory in the event of a power loss.
- I. Slip compensation shall be a software enabled function, if required.
- J. The software shall have a No Load function that will reduce the voltage to the motor when selected for variable torque loads. A constant Volts/Hz ratio will be maintained during acceleration. The output voltage will then automatically adjust to meet the torque requirement of the load.
- K. The AC drive shall offer programmable DC injection braking that will brake the AC motor by injecting DC current and creating a stationary magnetic pole in the stator. The level of current will be adjustable between 50-150% of rated current and available from 0.0-30 seconds continuously. For continuous operation after 30 seconds, the current shall be automatically reduced to 50% of the nameplate current of the motor.
- L. Sequencing logic will coordinate the engage and release thresholds and time delays for the sequencing of the VFD output, mechanical actuation and DC injection braking in order to accomplish smooth starting and stopping of a mechanical process. Time delay can be an external option.

#### 2.10.8.12 Operator Interface Terminal

- A. The operator interface terminal will offer the modification of VFD adjustments via a touch keypad. All electrical values, configuration parameters, I/O assignments, application and activity function access, faults, local control, adjustment storage, self-test and diagnostics will be in plain English.
- B. The display will be a high resolution, LCD backlighted screen capable of displaying operating parameters in percentages, and alphanumeric characters.
- C. The VFD model number, torque type, software revision number, horsepower, output current, motor frequency and motor voltage shall all be listed on the drive identification display as viewed on the LCD display.
- D. The display shall be configured to display numeric data that is selectable and scalable by the operator. A user defined label function shall be available. As a minimum the selectable outputs shall consist of speed reference, output frequency, output current, motor torque, output power, output voltage, line voltage, DC voltage, motor thermal state, drive thermal state, elapsed time, motor speed, machine speed reference and machine speed.
- E. A single keystroke scrolling function shall allow dynamic switching between display variables.
- F. The terminal keypad will consist of predefined menus or programmable



function keys. The functions will allow both predefined menus or operating commands and programming options to be preset by the operator. A hardware selector switch or programmed password will allow the terminal keypad to be locked out from unauthorized personnel.

- G. The operator terminal will offer a general menu consisting of parameter setting, I/O map, fault history, and drive configuration. A software lock will limit access to the main menu. The main menu will consist of keypad configuration, drive configuration, general configuration, diagnostic mode and drive initialization screens.
- H. There will be arrow keys that will provide the ability to scroll through menus and screens, select or activate functions or increase the value of a selected parameter.
- I. A data entry key will allow the user to confirm a selected menu, numeric value or allow selection between multiple choices.
- J. An escape key will allow a parameter to return the existing value if adjustment is not required and the value is displayed. The escape function will also return to a previous menu display.
- K. A RUN key and a STOP key will command a normal starting and stopping as programmed when the VFD is in keypad control mode. Local STOP is not active in the remote control mode. Keypad will first have to be placed on local control mode for the VFD to be stopped locally.
- L. The VFD shall come with 3 LEDs mounted on the front panel to indicate functional status. A Green LED will verify that the VFD power supply is ON. A Red LED indicator will indicate an VFD FAULT. A Yellow LED indicator will designate a PENDING FAULT condition.
- M. A user interface shall be available that is a minimum Windows 3.1 based personal computer, serial communication link or detachable operator interface.
- N. The Keypad and all door mounted controls shall be Type 1 or Type 12 rated, as required.
- O. All adjustments made on the user interface shall be stored in nonvolatile memory. The user interface shall provide memory for factory default values as well as programmed user defaults.

#### 2.10.8.13 Control

- A. External pilot devices shall be able to be connected to a terminal strip for starting/stopping the VFD, speed control and displaying operating status. All control inputs and outputs will be software assignable.
- B. 2-wire or 3-wire control strategy shall be defined within the software. External relays or logic devices will not be allowed.
- C. The control power for the digital inputs and outputs shall be 24vdc.
- D. The internal power supply shall incorporate an automatic current fold-back that protects the internal power supply if incorrectly connected or shorted. The transistor logic outputs will be current limited and not be damaged if shorted or excess current is pulled.

- E. All control logic connections shall be furnished on a terminal strip separate from power wiring.
- F. There will be 2 software assignable analog inputs. The analog inputs will be software selectable and consist of the following configurations: 0-20 ma, 4-20 ma, 20-4 ma, x-20 ma (where x is user defined) 0-5 v, 1-5 v or 0-10 v. There will be 4 software assignable logic inputs that will be selected and assigned in the software. The selection of assignments shall consist of run/reverse, jog, plus/minus speed, setpoint memory, preset speeds, auto/manual control, controlled stop, terminal or keypad control, by-pass, motor switching, and fault reset.
- G. There will be two software assignable analog outputs that can be selected and assigned in the software. The analog output assignments shall be proportional to the following motor characteristics: frequency, current, power torque, voltage and thermal state. The output signal will be selectable from 0-20 ma or 4-20 ma.
- H. A minimum of two Form C relay output contacts will be provided. One of the contacts will indicate AC drive fault status. The other contact will be user assignable. There shall be a hardware input/output extension module which also provides interlocking and sequencing capabilities. The module shall be fully isolated and housed in an enclosure with terminal strips. The module will add 4 logic inputs, 2 analog inputs, 2 relay outputs and one analog output. All of the I/O will be user assignable in the software as previously defined.
- I. The VF Drive door mounted control area shall include a power ON, Drive RUN, Drive Fault Light and Hand-Off-Auto selector switch with Manual Speed Potentiometer.
- J. The VFD control island shall accept % indicating analog meters to display Power, Amperes, Voltage, Hertz.

#### 2.10.8.14 BRAKING

(Provide only if recommended by the VFD manufacturer for the type of motor(s) fan loads to be fed by the VFD)

#### 2.10.8.15 Harmonic Current Filtering

If deemed necessary by the VFD manufacturer, line reactors shall be provided in a stand-alone NEMA enclosure for mounting separately from the VF Drive. Line reactors (to reduce harmonics content) shall be of minimum 3% per unit impedance, and may be provided integral to the VF Drive. All line reactors, integral or external type, shall be provided by the VF Drive manufacturer as a part of the VFD package. If necessary power factor correcting capacitors may be provided in the filter circuit.

#### 2.10.8.16 Execution

- A. The contractor shall not install the VF Drive(s) until the building environment can be maintained within the service conditions required by the manufacturer. Before and during the installation, the VF Drive equipment shall be protected from site contaminants. Installation shall be in compliance with manufacturer's

instructions, drawings and recommendations.

- B. The Contractor shall provide a manufacturer's certified technical representative to supervise the contractor's installation, testing and start-up of the VF drive(s) furnished under this specification for the minimum number of days required for the technical representative to approve the installation and operation of the AC Drive. In addition, the manufacturer's technical representative shall provide training to the User's personnel.
- C. Six months after start-up, the contractor shall provide a manufacturer's certified technical representative to make a one-day site visit to inspect the VF Drive(s) and accessories.

#### 2.10.8.17 Training

An on-site training course of 3 training days shall be provided by a certified representative of the VF Drive manufacturer to the User's plant and/or maintenance personnel. The training course shall include VF Drive model brochures, and troubleshooting manuals that describe accurate procedures to follow for maintenance personnel to quickly isolate a cause for Drive failure.

#### 2.10.9 Motor-Disconnecting Means

Each motor shall be provided with a disconnecting means when required by NFPA 70 even though not indicated. For single-phase motors, a single or double pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Switches shall disconnect all ungrounded conductors.

#### 2.10.10 Convenience Receptacles

Unless otherwise noted, all convenience receptacles shall be heavy duty NEMA 5-15R, 125 volt, duplex grounding type, and shall be flush-mounted at 450 mm [18 inches] above finished floor (AFF). Provide convenience receptacles at 3048 mm [10 feet] on centers along perimeter walls and at 1524 mm maximum from doors in administrative office areas. Provide receptacles in support facility per NEC. Provide receptacles a maximum of 9000 mm [30 feet] on center in perimeter walls in corridors, lobby, and circulation areas for use of janitorial or other equipment. Where countertops are provided in rooms, provide receptacles above the countertop back splash. Provide at least one receptacle in storage rooms, janitor's closets, and bathrooms and one additional receptacle above the countertop in each bathroom. Bathroom receptacle outlets shall be supplied by at least one dedicated 20-ampere branch circuit. Provide ground-fault circuit-interrupter (GFCI) receptacles where receptacles are located within 1825 mm [6 feet] of sinks such as in the bathroom countertops, janitor's closets, Mechanical room, exterior locations, and other wet areas. Provide a GFCI receptacle outside the mechanical room and 1830 mm from the nearest outside mechanical equipment, mounted in a recessed box with a gasketed, weatherproof, cast-metal cover plate and hinged gasketed cap over each receptacle opening. Provide a minimum of five GFCI receptacles in each Mechanical and four GFCI receptacles in each Electrical Room, located to avoid mechanical and electrical equipment. Provide 6 receptacles at the telephone backboard, two on each wall and on 1524 to 2134 mm [5 to 7 foot] centers, with three receptacles maximum on a dedicated 20-ampere branch circuit. Unless otherwise noted, provide no more than six convenience receptacles on each 20-ampere branch circuit. Provide a receptacle located directly underneath electric water cooler units. For each administrative area workstation provide a minimum of two 20-ampere branch circuits. In accordance with UBC 4304 outlets in the same stud space and on

opposite sides of fire rated walls and/or partitions, must be separated by a minimum of 610 mm horizontal distance. Device face plates inside the building shall be nylon impact resistant type and ivory colored. Provide a NEMA 5-20R, 125 volt duplex grounding type, receptacle on a dedicated circuit for each copier; and, provide one each NEMA 5-15R receptacle on a dedicated circuit for a fax machine and a laser printer - coordinate quantity and fax, laser printer and copier room locations with the user. For the copier(s), verify the demand load amperes, and the required receptacle types with the user. Receptacle circuits shall not supply lighting loads.

#### 2.10.11 Clock Outlets

D-B Contractor shall coordinate with Architectural design.

#### 2.10.12 Equipment Power

Provide hard-wired dedicated circuits for power equipment or receptacles adjacent to equipment, as required by applicable sections of NFPA 70 and/or the equipment manufacturer, to serve equipment listed herein and in other narrative paragraphs that form a part of the Electrical section. This includes small 115-200 volt rated mechanical equipment such as fan coils, exhaust fans, or the digital energy management control system. Provide the required power to all lavatories sensors for automatic off/on operation, per manufacturer's specifications. Determine whether equipment will be gas or electric and then provide the applicable NEMA ampere-rated hard-wired circuits or receptacles (with a mating plug if the receptacle required for the equipment is other than the standard NEMA 5-15R or NEMA 5-20R). Other equipment includes administrative and office staff support equipment such as typewriters, personal computers, copiers, laser printers, and fax machines; non-administrative equipment includes the Fire Alarm System and Remote Annunciator, Fire Alarm Transceiver, audiovisual equipment, Energy Management and Control System and other communications equipment.

#### 2.10.13 Coordinated Power System Protection

Analyses shall be prepared of the building design electrical system to demonstrate that the proposed new equipment meets the specified requirements for connected equipment ratings, coordination, and protection. Provide short circuit calculations to determine fault current available at the service entrance switchboard, sub-panelboards, motor control centers, safety switches, and enclosed circuit breakers. Verify that equipment is provided with sufficient short circuit interrupting capacity to withstand these calculated fault current levels. The analysis shall include a load flow analysis, a fault current analysis, and circuit breaker protective device coordination study. The studies shall be performed by a registered professional engineer with demonstrated experience in power system coordination in the last three years. The contractor shall provide a list of references complete with points of contact, addresses and telephone numbers. The selection of the engineer is subject to the approval of the Contracting Officer.

#### 2.10.14 Miscellaneous Power Requirements

Provide one single receptacle for each electric water cooler (EWC). Place each EWC receptacle on a circuit with no more than three convenience receptacles besides the EWC receptacle. Provide power as required to auxiliary Mechanical equipment: Temperature Control Panels, Data Terminal Cabinets, Field Interface Devices and Air Terminal Units.

#### 2.10.15 Grounding

Ground the electrical system, all separately derived electrical systems, and all electrical equipment and metallic raceway bushings used by electrical conductors to comply with Article 250 and Special Occupancies Articles 500, 501, 502, 503, 513 and 516 of the NFPA 70. Provide an insulated green equipment ground conductor in all raceways regardless of the type of conduit. In raceways supplying grounding receptacles, connect the equipment grounding conductor to the grounding contact. The earth electrode system shall be engineered to obtain a resistance to ground of 25 ohms or less. Telecommunications rooms shall be grounded with a dedicated direct buried PVC duct and cable bonded to the service entrance power grounding electrode system, in compliance with TIA/EIA 607. Bond all ground rods provided for the service entrance switchboard, the padmounted transformer, the fire alarm transceiver radio antenna, and the communication room, at 305 mm [12 inches] below grade with a 4/0 bare copper cable. Due to the high corrosiveness of the soil, all bare copper cable exposed to the soil shall be type tinned copper, and all ground rods shall be solid copper.

All three bays shall have sufficient grounding receptacles in its floors for grounding of aircraft and support equipment. All grounding receptacles shall be connected to facility ground grid. Paint storage and mixing rooms shall also have inside grounding ring all around the rooms to allow availability of continuous point to racks, paint and solvent cans, equipment etc. Inside ground rings shall be solidly connected to the facility ground grid.

#### 2.10.15.1 Bonding

All metallic conductive parts including steel structures, HVAC ducts, process, media delivery systems, utility ducts and electrical conduits shall be bonded at separation joints throughout the length of the system to assure grounding continuity and safety of personnel from accidental contact. All external metallic penetrations such as electrical conduits, ducting and steam lines shall be bonded within 6" of entering the building to the protective grounded grid system.

#### 2.10.16 Voltage Drop

Size wiring for service entrance conductors to have a voltage drop of 1% or less. Size wiring for feeders to have a voltage drop of 2% or less. Size wiring for branch circuits to have a voltage drop of 3% at the furthest outlet of power, heating, and lighting loads. Size overall wiring so that the maximum combined voltage drop on both feeders and branch circuits to the furthest outlet of power, heating, and lighting loads is 5% or less. For branch circuits, include the required 25% spare capacity in the load levels used to determine these maximum voltage drop percentages.

#### 2.10.17 Exterior Lighting

##### 2.10.17.1 Wallpack (perimeter) Lighting

Lighting at the perimeter of the building shall be by wall mounted 90-degree cutoff wallpack type, or with recessed fixtures in the building architectural soffits, metal halide fixtures with lamp size of minimum 70 watts. If wall mounted fixtures, they shall be of the low profile type so as to minimize protrusion from wall (no jelly jar type fixtures). Physical dimensions of wall mounted fixture shall be proportionate to the installed wall fixture height (if the fixture height is 3 meters [10 ft] or less, do not provide an industrial fixture that is 300 mm x 300 mm x 150 mm D), and shall enhance the architecture of the building. Provide down lighting fixtures recessed in soffits near building entrance doors. Provide an illumination level of 10.76 lux [1 footcandle] at building surrounds and at inactive (normally locked) exterior doors, and 54 lux [0.5 footcandles] at active pedestrian or conveyance exterior

doors. Uniformity of illumination shall be in accordance with IES recommendations. Fixtures shall be rated 208 or 277 volts. Provide access to fixture ballasts to enable repair or replacement. Conduit and wiring to fixtures shall be recessed. Provide access to fixture ballasts to enable repair or replacement. Wall mounted fixtures shall be provided with U.V. stabilized polycarbonate lenses.

#### 2.10.17.2 Exterior Lighting Control

Provide separate lighting circuits for the building perimeter lighting fixtures. Provide each circuit with combination photocell/timeclock control with manual override. Provide a Lighting Control Cabinet (LCC) in the Electrical room to house lighting contactors, timeclocks, and manual override (ON-OFF-AUTO) selector switch located on the cover. Provide a photocell control ON and timeclock OFF control. The photocell unit provided shall have an adjustable sensitivity range, and shall be mounted on the edge of the roof overhang oriented to north. Provide one spare photocell inside the LCC.

#### 2.10.17.3 Ballasts

All exterior lighting fixture ballasts shall be high power factor type, 100% factory tested, and with temperature rating of 0 degrees F.

#### 2.10.17.4 Polystyrene Lenses

Do not use any polystyrene lenses in light fixtures.

#### 2.10.18 Interior Lighting

No occupancy sensor control shall be permitted in this facility.

##### 2.10.18.1 Lamp and Ballast Types

The following electronic ballast specification shall be for 2 foot and 4 foot long 32 watt, T-8 fluorescent rapid start lamps and compact fluorescent ballasts compact fluorescent 4-pin lamps. Electronic ballasts shall consist of a rectifier, high frequency inverter, and power control and regulation circuitry. The ballasts shall be UL listed, class P, CSA approved, with a Class A sound rating and shall contain no PCBs. Ballasts shall meet 47 CFR 18 for electromagnetic interference and shall not interfere with the operation of other electrical equipment. Ballast design shall withstand line transients per IEEE C62.41, Category A. Unless otherwise indicated, the minimum number of ballasts shall be used to serve each individual fixture, using one, two, three or four lamp ballasts. A single ballast shall not be used to serve multiple fixtures. Electronic ballasts for F17T8, F25T8 and F32T8 lamps shall be from only one manufacturer and shall be rapid start type. Electronic ballasts for 4-pin compact fluorescent lamps may be from another single manufacturer. Each ballast manufacturer shall furnish test reports from an independent testing laboratory, such as ETL, to verify that their ballasts meet all of the following requirements:

- A. Light output regulation shall be +/- 10%, for +/- 10% input voltage range.
- B. Voltage input regulation shall be +/- 10%, for +/- 10% input voltage range.
- C. Lamp current crest factor shall be no more than 1.6.
- D. Ballast factor shall be not less than 85% nor more than 100%.

- E. A 60 Hz filter shall be provided. Flicker shall be no more than 1.5% with any rapid start lamp suitable for the ballast. Unless otherwise noted, T-8 lamps shall have a correlated color temperature of 3500 Kelvins and a minimum color rendering index (CRI) of lamps shall be 82.
- F. Ballast case temperature shall not exceed 25 degree Celsius rise above 40 degree Celsius ambient, when tested in accordance with UL 935.
- G. Total Harmonic Distortion (THD) shall not be more than 10%
- H. Power factor shall not be less than 98% at full light output
- I. Ballasts shall operate at a frequency of 20 kHz or above.
- J. Operating filament voltage shall be 2.5 to 4.5 volts.
- K. Operating mode shall be rapid start
- L. Warranty. Three year full warranty including a \$10 labor allowance.
- M. Ballasts shall be inaudible in a 27 dB room ambient throughout the dimming range.
- N. Ballast Efficacy Factor (BEF) for ballasts shall meet the requirements specified in Army Engineering Technical Letter (ETL) 1110-3-441. However, all electronic ballast requirements specified herein shall take precedence over similar and conflicting information provided in ETL 1110-3-441.

#### 2.10.18.2 Lighting Illumination Levels

Lighting for the facility shall be designed per IESNA's recommendations published in 9<sup>th</sup> edition and/or AFMAN 3211-8. Preliminary energy conservation analysis by COE indicates that a minimum maintained lighting-level of 100FC will be needed in paint-bay and 75 FC lighting -level will be needed in stripping (DMB) and wash-bays **at 30" above ground level**. Optimum good lighting shall be designed keeping in mind human comfort, energy conservation and functions carried out in each of 3 bays indicated.

***Following specific design considerations will elaborate Govt. requirements and concerns to have adequate light-levels (in foot candles) for the specific functions in each of 3 bays. All lighting shall comply with Article 516 of NEC, as applicable. Point source light shall not be considered in paint bay because of glare, particularly on walls. Diffused type of light is preferred.***

#### **Paint Bay**

***100 FC white light is required on all aircraft surfaces (that are within 20' of the top and sides of the enclosure) to ensure uniformity of applied paint and uniform color rendering index. All surfaces shall mean all horizontal & vertical surfaces including top & sides of aircraft. Portable lights shall not be needed if Govt. decides for the option item as described under section 2.10.18.11 Paint Hangar in Floor lighting.***

#### **DMB and Wash Bays**

***75 FC light is required on top and vertical surfaces of the aircraft. Good***

**visibility and worker safety are the main concerns. There is no specific requirements for lighting underside of the aircraft. Proposer at his\her option may recommend all ceiling mounted lights or both wall and ceiling mounted lights for best lighting on the aircraft and the bay.**

All other spaces shall be lighted to maintain light-levels which are optimum good lighting for the function in the specific space. Consult IESNA's 9<sup>th</sup> edition, AFMAN-3211-8 and COE's A\E design guide. Additionally all hangar lighting shall comply with NFPA\NEC hazardous occupancy requirements.

#### ~~2.10.18.3 Day Lighting (Referred As Option Bid Item Under Pricing Schedule)~~

~~Day-lighting application shall be developed considering energy conservation, HVAC effectiveness, reflectances of wall-glazings, all other energy efficiency measures and comforting lighted environment. Day-lighting shall be designed around 9<sup>th</sup> Edition of IESNA and US Air Force's "ETL 00-1". Day lighting application shall be modeled around Benefit to Cost ratio of more than one in favor of US Government and to achieve a minimum Daylight Factor of 2% (excluding all direct sunlight penetration) in 75% of all space occupied for critical visual tasks, not including copy rooms, storage areas, mechanical, laundry and other low occupancy support areas.~~

~~Sun avoidance techniques should employed to reduce thermal comfort loads. In addition to insulation, ventilating roof\wall surface, exterior window shades, roof overhangs\awnings, fritted glazing, refractive glazing, interior light shelves and awnings may be of value.~~

#### 2.10.18.4 Fixture Selection Considerations

Fixture selection shall be based on the principle of lighting optimization. It is the intent to conserve energy and maximize visual comfort thru utilizing most efficient light fixture considering the reflective effect of wall finishes and\or glazes. ~~D-B contractor's design must be based on the inclusion of direct-indirect light fixtures to maximum extent. All lighting design calculations shall also be based on use of direct-indirect light fixtures for optimum lighting and efficiency.~~

##### 2.10.18.4.1 Office/Admin Areas

Fixture types listed in the paragraph above have been chosen for energy efficiency and for the suitability of their light output, appearance, and high-visual-comfort probability (VCP) for the function of the space they are used in. Parabolic louvered fixtures are highly efficient, present an attractive appearance, and reduce high angle glare resulting in a high visual comfort probability. Provide 114 mm deep louvers, measured from the surface to the center of the lamp, for all parabolic louvered fixtures. Compact fluorescent downlights are somewhat less efficient but have a lower profile appearance and light output due to their smaller size and lamp wattages. This makes them more suitable for spaces with lower illumination levels and where it is desirable to reduce fixture area so as to be more unobtrusive. Industrial fluorescent fixtures are recommended for rooms where the ceiling is exposed to the roof. Surface mounted fluorescent wraparound fixtures are recommended for stairwells (wall mounted, or ceiling mounted to concrete deck).

##### 2.10.18.4.2 Fixtures Types in Lower Illumination Areas

In corridors use either a 300mm x 1200mm [1 x 4 ft.] one lamp or a 600mm x 1200mm [2 x 4 ft.] two lamp parabolic louvered fixture. In Vestibules and Men's and Women's Restrooms, use compact fluorescent downlight fixtures with clear specular Alzak reflectors and two 13 watt compact fluorescent lamps. In



restrooms, provide additional fluorescent fixtures over lavatory areas to adequately light the front of people looking in mirrors over sinks (additional fixtures shall be two lamp recessed fluorescent linear strips).

#### 2.10.18.4.3 Fixture Types in Higher Illumination Areas

Fixtures in areas requiring 538 lux illumination levels and larger shall be 600mm x 1200mm 2 or 3 or 4 lamp. Larger rooms (rooms with a Room Cavity Ratio (RCR) of 4 or less shall be provided with 2 lamp fixtures in order to avoid exceeding the 538 lux engineering level while maintaining close enough spacing to achieve acceptable uniformity. Smaller rooms (rooms with an RCR of 5.5 or greater) shall be provided with 3 lamp fixtures. Rooms with an RCR between the values of 4 and 5.5 may be provided with either 2 or 3 lamp fixtures depending on the particular room configuration. Rooms such as this with a circulation space within the room that is fairly clearly defined can be provided with 3 lamp fixtures because the whole room does not have to be covered to the same general level of illumination. Rooms with lux levels of 807 to 1076 may require the use of 4-lamp fixtures to meet the design light level. **Fluorescent fixtures shall be used in the Paint bay for ceilings and walls.**

#### 2.10.18.4.4 Fixture Type in Mechanical, Electrical and Communications Rooms

Use two lamp industrial type fluorescent lighting fixture with 8 to 15 percent uplight with protective wire grills.

#### 2.10.18.4.5 Support of Pendant Mounted Fixtures (Only in Administration Area & Support Facility Areas)

Fixtures shall not be supported from the underside of the roof deck. Suspension of fixtures shall be from structural members where spacing of structural members coincides with required fixture spacings. Where fixture spacing does not coincide with structural supports, provide steel channels mounted between and connected to structural members for support of pendant mounted fixtures.

#### 2.10.18.5 Fixture Spacings

For rooms to be illuminated to levels of 538 lux, the following spacing requirements shall govern. For rooms with nine foot high ceilings, spacing between fixtures shall not exceed 2400mm in the parallel axis of the fixtures and 3000mm in the perpendicular axis of the fixtures. For rooms with eight foot high ceilings, spacing between fixtures shall not exceed 2400mm in the parallel axis of the fixtures and 2400mm in the perpendicular axis of the fixtures. Spacing to walls should be one-half of these values or less, preferably one third of these values. The exception to this would be where there is a clearly defined circulation space along a wall due to door placements and other room configuration factors. Provide 300mm x 1200mm one lamp or 600mm x 1200mm two lamp parabolic louvered fixture oriented longitudinally down corridors. Perpendicular spacing between fixtures in dedicated circulation spaces such as the corridors may be as high as 3600mm because the uniformity of illumination in these areas is not as critical due to the less demanding visual task.

#### 2.10.18.6 Ballasted Fixtures

Ballasted fixtures shall have ballasts which are compatible with the specified type and rating of lamps indicated and shall comply with applicable provisions of the publications referenced. Interior fixtures shall be NEMA LE 4 and UL 1570 for ceiling compatibility of recessed fixtures. Fixtures shall be plainly marked for proper lamp and ballast type to identify lamp diameter, wattage, color and start type. Marking shall be readily visible to service personnel, but not visible from normal viewing angles.

#### 2.10.18.7 Dimming and Switching Requirements

Each room or distinct functional area within each room shall be individually switched. Provide multi-level switching of three lamp fixtures. Consider sectionalizing lighting switching in Corridors (where the corridors are broken up by the intersection of the corridors). Provide three and four way switching for rooms with multiple entrances and at each end of corridor segments.

#### 2.10.18.8 Fluorescent Lamps

Fluorescent lamps shall be of the rapid-start type, and shall not require starter switches. All fluorescent F17T8, F25T8, and F32T8 lamps shall be for electronic ballasts and shall have a correlated color temperature of 3500 Kelvins and a minimum color rendering index (CRI) of 82. Provide fluorescent lamps with stick coil cathodes to eliminate end darkening. Fluorescent lamps shall be listed as low mercury type.

#### 2.10.18.9 Compact Fluorescent Lamps

Compact fluorescent lamps shall be socketed replaceable type and shall have a minimum of 10,000 hour lamp life based on minimum 3 hours per start. All lamps shall have a correlated color temperature of 3500K and 85 CRI. Compact fluorescent lamps shall be for electronic ballast type, and either 13 watt with base type G24q-1 or 18 watt with base type G24q-2.

#### 2.10.18.10 Exit and Emergency Lighting

Provide exit and emergency lighting in accordance with the requirements of NFPA 101, Life Safety Code. Provide battery backup for exit and emergency lighting fixtures. Exit lighting fixtures shall use a light emitting diode light source and shall be red color. Provide integral emergency lighting unit (similar to OCE 40-06-04 type XF-1, listed for installation in specific locations) in ballast wireway of long fluorescent fixtures with emergency feature. Provide emergency lighting frame-in kits mounted at fixture for compact fluorescent fixtures with emergency feature. Emergency light fixtures shall be so arranged to provide minimum 1 foot candle at floor level, complying with NFPA 101. "Bugeye" type emergency lights (floodlight heads mounted atop a battery unit, or mounted separately) shall not be used. Provide a minimum of one emergency lighting fixture in each room located near a room door that leads to the nearest building exit door, and one on each stairwell landing. Back-up battery and lamp supply unit in emergency fluorescent light fixtures shall be wired to energize only during a power outage, or upon opening of the branch circuit breaker.

#### 2.10.18.11 Paint Hangar In-Floor Lighting

Provide built-in upward-directed in-floor lighting under the wings and belly of aircraft, only in the paint hangar. This in-floor lighting system is intended to increase lighting (foot-candle) levels where illumination is low. All in-floor lighting shall be designed to comply with applicable hazardous class\division classification.

#### 2.10.18.12 Lighting Circuiting Requirements

Lighting circuits shall not be loaded above 12 amps.

#### 2.10.18.13 Metric Light Fixtures and Ceiling Grids

Contractor may at his option provide non-metric light fixtures to coordinate with a non-metric ceiling grid.

#### 2.10.18.14 Light Fixture Sources

Contractor shall provide sources (name, mailing address and phone number) for obtaining of replacement parts for all light fixtures, including all lamps and ballasts.

#### 2.10.18.15 Seismic Restraint of Lighting Fixtures

Lighting fixtures and supports shall conform to minimum seismic requirements of zone 3 and TO 809-04.

#### 2.10.18.16 Lighting Fixtures in Buildings

Lighting fixtures shall be malleable iron, conforming to UL requirements and shall be as following:

A. Pendant Fixtures: Loop and hook or swivel hanger assemblies for pendant fixtures shall be fitted with a restraining device to hold the stem in the support position during earthquake motions. Pendant-supported fluorescent fixtures shall also be provided with a flexible hanger device at the attachment to the fixture channel to preclude breaking of the support. The motion of swivels or hinged joints shall not cause sharp bends in conductors or damage to the insulation.

B. Recessed Fluorescent Fixtures: Recessed fluorescent individual or continuous-row mounted fixtures shall be supported by a seismic-resistant suspended ceiling support system and shall be fastened thereto at each corner of the fixture with bolts or approved clips; or shall be provided with fixture support wires attached to the building structural members using two wires for individual fixtures, attached to opposite corners, and one wire per unit of continuous row mounted fixtures. Each wire support shall be capable of supporting four times the weight of the fixture. Recessed lighting fixtures not over 25 kg in weight and suspended or pendant-hung fixtures not over 10 kg in weight may be supported by and attached directly to the ceiling system runners by a positive attachment such as screws or bolts, number and size as required by design seismic zone. For fixtures in essential and hazardous facilities, accessories, including louvers, diffusers, and lenses shall have lock or screw attachments.

C. Assembly Mounted on Outlet Box: A supporting assembly that is intended to be mounted on an outlet box shall be designed to accommodate mounting features on 100 mm boxes, 75 mm plaster rings, and fixture studs.

D. Surface-Mounted Fluorescent Fixtures: Surface-mounted fluorescent individual or continuous-row fixtures shall be attached to a seismic-resistant ceiling support system. Fixture support devices for attaching to suspended ceilings shall be a locking-type scissor clamp or a full loop band that will securely attach to the ceiling support. Fixtures attached to underside of a structural slab shall be properly anchored to the slab at each corner of the fixture.

E. Wall-Mounted Emergency Light Unit: Each wall-mounted emergency light unit shall be secured to remain in place during a seismic disturbance.

F. Lateral Force: Light fixture bracing shall be designed to resist the Lateral Force Coefficient (g) times the fixture weight. Select the appropriate lateral force coefficient (as a portion of gravity) for the

fixture weight according to the seismic zone:

Zone	Lateral Force Coefficient (g)
1	0.28
2B	0.75
3	1.13
4	1.50

2.10.18.17 Suspended Ceiling Assemblies: The structural members of ceiling support systems, used primarily to support acoustical tile panels or acoustical panel lay-in tiles, with or without lighting fixtures, ceiling-mounted air terminals, and ceiling-mounted services, shall conform to the following:

- A. Design Loads: The main runners and cross-runners and their splices and intersection connections shall be designed for two times the design load or ultimate axial tension or compression (minimum 550 N). The connections at the splices and intersections shall be of a mechanical interlocking type that cannot easily be disengaged. Ceiling structural systems shall be designed to withstand required vertical load as well as a lateral force of a Percent of the ceiling weight. The ceiling weight shall include all lighting fixtures and other equipment that are laterally supported by the ceiling and shall be not less than 200 Pa. Select the appropriate percent of ceiling weight according to the Seismic Zone 2, 3, and 4:

Zone	Percent
2	11.3
3	23
4	30

- B. Exception: Ceiling areas of 13 square meters or less surrounded by walls that connect directly to the structure above will be exempt from the lateral-load standards of this specification.
- C. Installation Requirements: Installation requirements shall be in accordance with ASTM E 580 except as follows:

Vertical Support: Hanger wires supporting a maximum tributary ceiling area of 1.5 square meters shall be a minimum of 10 gauge in diameter. The size of wires supporting a tributary ceiling area greater than 1.5 square meters shall be substantiated by design calculations. Hanger attachment devices used in ceiling systems not exceeding 200 Pa shall be capable of supporting a minimum allowable load of 1.3 kN. Hanger attachment devices used in ceiling systems exceeding 200 Pa shall be capable of supporting the design load and shall be substantiated by design calculations. If hangers must be splayed more than one horizontal to six vertical, the resulting horizontal force shall be offset by bracing or counter-splaying, and substantiated by design calculations.

Lateral Support: In lieu of the design criteria stated above, where ceiling loads do not exceed 200 Pa, lateral support for the ceiling system may be provided by four galvanized wires of minimum No. 12 gauge, as indicated in ASTM E 580, paragraph 4.4.6.

- D. Lighting Fixture and Air Diffuser Supports: Lighting fixture and air diffuser supports shall be designed and installed to meet the

requirements of equipment supports in the preceding paragraphs of this document with the following exceptions: Recessed lighting fixtures not over 25 kg in weight (and not suspended 457 mm or more below the point of attachment) and suspended and pendent-hung fixtures not over 10 kg in weight may be supported and attached directly to the ceiling system runners by a positive attachment such as screws or bolts; Air diffusers that weigh not more than 10 kg and that receive no tributary loading from ductwork may be positively attached to and supported by the ceiling runners.

## 2.10.19 Fire Alarm System

### 2.10.19.1 Scope

Provide and place in operating condition a multiplex automatic fire alarm control panel (FACP) and alarm system that is solid state microprocessor-based, addressable and intelligent, as described herein, and in strict accordance with NFPA 72. The system shall include, but not be limited to, a FACP, a Graphic Remote Annunciator, and a Transceiver and radio antenna system, power supplies, initiating devices, notification appliances, conduit, wire, fittings, and all accessories required to provide a complete operating system. The complete Fire Alarm System and Graphic Annunciator, except for the Transceiver System, shall be the product of only one manufacturer. **Fire alarm transceiver shall be a Monaco BT2-8NB (16 zone) or BT2-8NB (32 ZONE) compatible with the Base Station's existing Monaco D-750 Radio Fire Alarm monitoring Systems.** The FACP shall provide dynamic supervision of system electronics, wiring, manual pull stations, smoke detectors, software, and other detection devices. The FACP shall be capable of measuring and adjusting the sensitivity of detectors from the FACP. An alphanumeric display shall be provided to display custom messages and give readings of detector sensitivity, detector by detector. The FACP shall have the ability to perform multiple operations at the same time. These operations shall include but not be limited to timed functions and multiple configured sequences. Provide main fire alarm control panel with the local capacity to accept the total number of analog/digital inputs and signaling line circuits. The number of signaling line circuits and indicating appliance circuits required for the initiating and indicating devices shown on the plans shall be determined by the manufacturer's limit of devices per circuit. The contractor shall not exceed the maximum resistance and capacitance values specified by the manufacturer for each signaling device circuit or indicating appliance circuit. Each device on a signaling line circuit shall be checked continuously to include the following: sensitivity, response, opens, shorts, ground faults functionality and status. Provide a 20% capacity for future modifications. Transmission of alarm to the Hill AFB Fire Department shall be by a radio transceiver and roof mounted antenna system. Provide radio transmission signal by means of a Fire Alarm Transceiver and radio antenna system, that is 100% compatible with existing Central station equipment. Transmission of an ALARM to the Hill AFB Fire Department shall occur only upon actuation of either the Water Flow Switch, a smoke detector, any Manual Pull Station or a Duct Smoke Detector. FACP and Transceiver shall be provided with separate and independent 24 volt D.C. battery backup & re-charging systems sized to meet system requirements in accordance with NFPA 72. Spare parts shall be distributor stocked within 90 miles. Provide separate power branch circuits for the fire alarm control system and the transceiver, including the appropriate conduit, wires, dedicated circuit breakers, and ground wiring. Label branch circuits at the panelboard as Fire Alarm Control Panel, Graphic Annunciator, and Fire Alarm Transceiver.

### 2.10.19.2 Initiating and Indicating Circuits

Fire alarm system shall provide coverage using automatic addressable type smoke detection system to be monitored by the FACP. Addressable smoke detectors shall

be type photoelectric. Provide addressable manual pull stations at all exits from the building, and along any paths of egress in excess of 61 meters [200 ft], for manual alarm notification capability per NFPA 101, Life Safety Code. Provide supervision of water flow switch to annunciate a general building Alarm upon a sprinkler system activation. Provide supervised circuits for the tamper switches of the Post Indicator Valves and OS&Y shut-off valves to annunciate a trouble condition if the shut-off valves are in the closed position. Manual pull stations shall be provided semi-flush on the wall at 1370 mm [54 inches] above finished floor. Provide duct smoke detectors in main return air ducts and in main supply air ducts of the kitchen and building HVAC systems, where duct air flows are above levels stipulated in the NFPA 72 code. Duct smoke detectors shall be addressable and 100% compatible with the main FACP and powered and monitored by the FACP. Provide control interlocking circuits via the duct detectors to shut down the air handler motor starter. Wherever required. HVAC interlocks shall be provided in fire alarm control panel to shutdown selected ventilation equipment upon alarm activation. Provide indicating circuits with sufficient number of combination alarm audible & visual or visual-only indicating appliances within building to notify all occupants upon alarm. All interior audio horn signals shall be 4 tone temporal whooping type with a minimum sound rating of at least 85 dBA at 3.048 meters (10 feet). Horns used in exterior locations shall also be 4-tone temporal whooping type and specifically listed or approved for outdoor use and be provided with metal housing and protective grills. Provide visual-only alarm devices in all restrooms. Zone alarm indicating appliance circuits separately to aid troubleshooting. Each fire alarm initiation, signaling, and notification circuit shall be Class A (Style as indicated) with a return loop, to the main fire alarm panel, in a separate conduit. All fire alarm initiation devices, smoke detectors, manual pull stations, and duct smoke detectors, shall be on Style Ea (Class A) for initiating device circuits and Style 6a (Class A) for signaling line circuits. Wiring for signaling line circuits shall be minimum #16 AWG twisted pair with shielded jacket per NFPA 72. Indicating appliance circuits for combination audible horn & visual strobes or visual strobes-only notification appliances shall be type Style Z (Class A), #14 AWG minimum. Visual strobes shall be ADA rated, one to three Hertz flash rate, and effective intensity of 75 candela. Conduit for all fire alarm system shall be minimum 21 mm [3/4 inch]. All cables shall be per the transceiver or FACP manufacturer's recommendations. All conduits shall be installed concealed above acoustical ceiling or in walls, except in mechanical/electrical room. Sprinkler water flow switch alarm and PIV tamper switch shall be required to be distinguished by device type, and a room number for water flow switch only.

#### 2.10.19.3 Graphic Remote Annunciator Panel

Provide a flush-mounted graphic remote annunciator panel in the main lobby of this facility which provides graphical representation of the entire facility. Locate this panel such that it is readily visible to fire department personnel when entering the lobby through the main entrance doors. Annunciator shall have relampable indicator lamps and an alphanumeric display. The lamp (LED) for the proper zone shall flash upon any alarm, supervisory or trouble condition on the fire alarm system. The alphanumeric display shall describe the zone activated. Annunciator lamps shall be extinguished only by operating the alarm reset switch on the control panel. Annunciator shall contain a lamp test switch, an audible trouble signal and a trouble silence switch to silence the audible alarm, but not extinguish the trouble lamp. Switches shall be located within a locked panel, and easily visible through a glass or plastic viewing plate. Panel door shall have a keyed lock identical to the lock on the control panel. Zone identification shall be by silk-screened or engraved labels and shall consist of word description of the zone location and device type.

#### 2.10.19.4 Minimum Installer Qualifications

Design of fire alarm system shall be done by a registered National Institute for Certification in Engineering Technologies (NICET) Level 4 Designer, with at least 3 years of current and applicable experience in similar designs. The design drawings must bear the Designer's NICET Level 4 Certification and signature.

#### 2.10.19.5 Submittals

Fire alarm system submittals shall include spare parts data, and battery, charger and voltage drop calculations for the fire alarm system. Submittals shall include detail drawings and instructions for the fire alarm reporting system. Submittals shall include detailed test procedures, submitted 60 days prior to performing system tests. Test reports in booklet form showing all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system, shall be submitted (each test report shall document all readings, test results and indicate the final position of controls). All submittals shall be signed and stamped by the qualified fire alarm system installer.

#### 2.10.19.6 Testing

The Contractor shall notify the Contracting Officer 30 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise all tests. The Contractor shall furnish all instruments and personnel required for the tests.

##### 2.10.19.6.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance. Tests shall include the meggering of all system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional.

##### 2.10.19.6.2 Acceptance Test

Testing shall be in accordance with NFPA 72H. The recommended tests in NFPA 72H shall be considered mandatory and shall verify that all previous deficiencies have been corrected. The test shall include the following:

- A. Test of each function of the control panel.
- B. Test of each circuit in both trouble and normal modes.
- C. Tests of alarm initiating devices in both normal and trouble conditions.
- D. Tests of each control circuit and device.
- E. Tests of each alarm notification appliance.
- F. Tests of the battery charger and batteries.
- G. Complete operational tests under emergency power supply.

- H. Visual inspection of all wiring connections.
- I Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.
- J. Ground fault
- K. Short circuit faults
- L. Stray voltage
- M. Loop resistance

#### 2.10.19.7 Field Training

Provide field training course (minimum 4 hours) in operation and maintenance of the fire alarm system for base personnel.

#### 2.10.19.8 Base Fire Alarm Reporting System

The base fire alarm reporting system shall be via radio-antenna system.

#### 2.10.19.9 Phasing of Fire Alarm Tests

The fire alarm system tests shall be phased with the building construction. All fire alarm systems/equipment in the addition shall be tested prior to occupancy and ahead of the remodeled area. All fire alarm equipment in the remodeled area shall be tested separately, after this phase of the construction is completed. No areas of this facility shall be approved for occupancy by the user prior to conducting fire alarm tests to obtain acceptance of that portion of the system by the Hill AFB fire department and the Contracting Officer.

#### 2.10.19.10 Approval by Hill Air Force Base Fire Department

The Base fire dept shall review the intermediate (35% or 65%) design submittal, and shall have final approval signature on final design submittal.

#### 2.10.20 Concealed Wiring and Conduit: All wiring and conduit in the office spaces shall be concealed.

#### 2.10.21 Lightning Protection Systems and Static Electricity Grounding.

Building shall have lightning protection, designed and constructed as per NFPA 780 and all conductive surfaces shall be electrically bonded and grounded per NFPA 33. All down conductors shall be verifiable and shall terminate into ground wells. **Crimping connectors are not acceptable instead exothermic welds are required.**

#### 2.10.22 Seismic Considerations.

##### 2.10.22.1 Seismic Bracing

Hill AF Base is in seismic zone 3. Provide seismic bracing or restraints for electrical equipment (transformers, lighting fixtures, etc.) in accordance with the requirements of this RFP and TI 809-04 , and per ELECTRICAL SEISMIC PROTECTION Section 16070.

#### 2.10.23 Device Body and Coverplate Colors

##### 2.10.23.1 General



Device bodies and coverplates for wall switches, power and communications outlets shall be a color which harmonizes with the room in which they are located. All devices in the same room shall be the same color.

#### 2.10.24 Electrical Device Locations and Labels

##### 2.10.24.1 Device Locations

Device locations inside the hangars shall be governed by hazardous occupancy Articles NEC 501, 510 and 513 and other applicable articles. Inside the offices; locations and colors of devices shall be coordinated with interior designer/system furniture. Device locations shall also be coordinated with all disciplines to prevent conflict and safety hazard.

##### 2.10.24.2 Mounting Heights

Outlets shall be mounted above countertops and sinks where it is appropriate to do so, such as in bathrooms and break rooms. Power receptacles, telephone/data outlets, and Cable TV outlets shall be mounted at the same mounting heights on blank walls (375mm min.) and above countertops (around 150mm above countertop), to provide a uniform horizontal outlet arrangement, unless noted otherwise. Mounting height shall be determined (maintaining necessary clearances) from the hazardous areas.

##### 2.10.24.3 Device Labels

All electrical devices will have permanent identification labels on each device indicating its function.

#### 2.10.25 Existing Site Conditions:

##### 2.10.25.1 Contractor Responsibility

Existing Site conditions, for both exterior and interior work, have been investigated and described in this RFP in accordance with the best knowledge available at the time this document was prepared. The contractor shall be fully responsible to verify all existing site conditions as they may affect him.

#### 2.10.26 Year 2000 Compliant Equipment

##### 2.10.26.1 Controls

Controls which include an internal clock feature, such as system control panels, shall be year 2000 compliant and shall be able to accurately process date/time data (including, but not limited to, calculating, comparing, and sequencing) from, into and between the twentieth and twenty-first centuries, including leap year calculations, when used in accordance with the product documentation provided by the contractor, provided that all products (e.g. hardware, software, firmware) used in combination with other information technology, shall accurately process date/time data if the other information technology properly exchanges date/time data with it.

## 2.11 COMMUNICATIONS REQUIREMENTS

### 2.11.1 General

Telephone and Local Area Network system shall be per 75<sup>th</sup> Communications Squadron's document "Design Criteria For Pre-Wiring And Other Telecommunications Systems" included in an attachment in D-B RFP package. In case of conflict with the requirements listed hereunder, stringent requirements of "Design Criteria For Pre-Wiring.....".document will prevail.

### 2.11.2 Category 5 System Tests

The contractor shall notify the Contracting Officer and the Communications Squadron, 21 days before the acceptance tests are to be conducted. The category 5 data transmission system shall be tested to confirm that it transmits data at the industry standard rated capacity (100 Mbps for cat.5 data transmission). Contractor shall provide all necessary equipment required to properly test the data transmission systems. Specific tests shall include;

### 2.11.3 Copper Cable Tests

Cable tests shall be performed with all cables in place. A Cable Status Certificate form shall be used to document cable tests. Testing shall be performed in accordance with REA Bulletin 345-63, PC-4 for Shield Continuity, Conductor Insulation Resistance and DC Loop Resistance Measurements and EIA/TIA -568 for attenuation, capacitance and near end crosstalk (NEXT). All defective pairs, except those noted as defective by the manufacturer in accordance with the applicable cable specifications shall be made good by the contractor. The government will retest to verify contractor's final test results.

### 2.11.4 Qualifications

All communications wiring shall be installed by a telecommunication Contractor who shall have a minimum of three years experience in the design, installation and testing of these specified systems.

### 2.11.5 Backboard

Provide 2440mm by 19mm plywood backboard on all three walls of the communications room. Backboards shall be laid out to most efficiently utilize the space. Provide type 110 terminal blocks on insulating mounting brackets at TTB's for terminating of telephone station cables. Terminal block layout (pattern) shall be symmetrical. Data station cables shall be terminated at TTB's on modular RJ45 patch panels. Service entrance cable (provided by the Government) and station data cables shall have separate designated areas on the backboards. Reserve empty board space for other communications cables to be brought in by the government.

### 2.11.6 Grounding

Provide a Ground Bar mounted on standoff insulators with 100mm H x 254mm L x 1/4" T copper and 12 drilled and tapped attachment holes, at lower left corner of each telecommunications room plywood backboard. Provide #1/0 AWG copper ground wire in a 21mm PVC conduit to interconnect the Ground Bar to the building grounding electrode system. Telecommunications rooms shall be grounded to the power grounding electrode system, in compliance with TIA/EIA 607. The grounding system shall be designed to obtain a resistance to ground of 10 ohms or less.

### 2.11.7 Communication Room environmental

Comm. rooms with 4 walls and an entry door, shall be environmentally controlled from 64 degrees F to 75 degrees F, with humidity 55% RH. Avoid dust and static electricity by installing floor tile and treating walls and ceiling to minimize dust. Install the same (key) locks on all comm. closet doors: coordinate with the Base Communications Squadron.

2.11.18 Public Address or Intercomm. System

Provide public address and intercom. system for the facility.

2.11.9 Execution

Install all equipment in accordance with manufacturer=s instructions. Provide proper grounding of system components and wiring.

2.11.10 Testing and Commissioning

Test each system and subsystem in the presence of Contracting Officer and\or his designated Representative.

